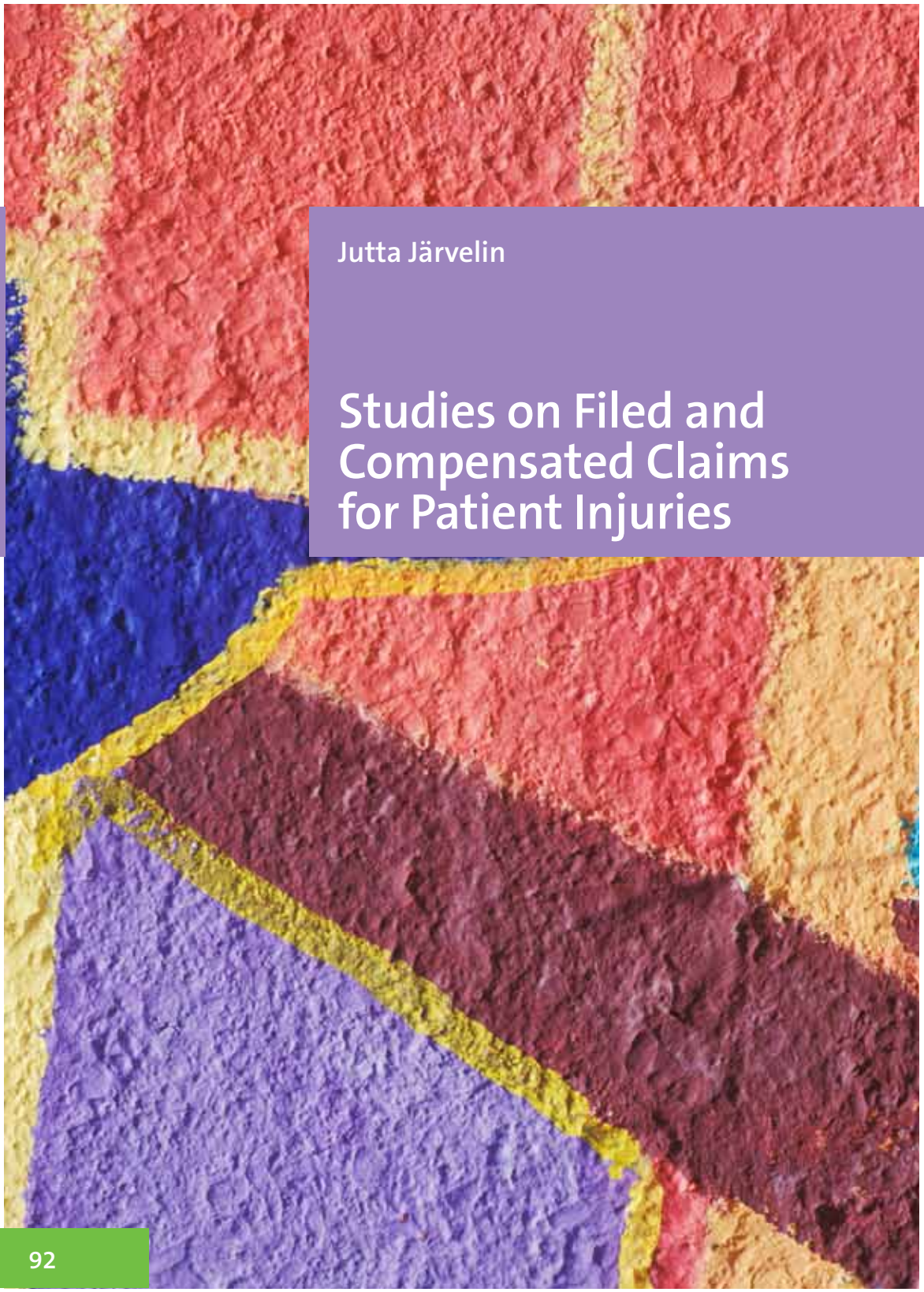

RESEARCH

Jutta Järvelin

Studies on Filed and Compensated Claims for Patient Injuries

RESEARCH 92/2012

Jutta Järvelin

Studies on Filed and Compensated Claims for Patient Injuries

Academic Dissertation

To be presented with the permission of the Faculty of Medicine,
University of Helsinki, for public examination in Auditorium XV
of the University Main Building, Unioninkatu 34,
on November 9, 2012, at 12 o'clock noon

Hjelt Institute
Department of Public Health
Faculty of Medicine
University of Helsinki

NATIONAL INSTITUTE
FOR HEALTH AND WELFARE

Layout: Raili Silius

ISBN 978-952-245-749-3 (printed)
ISSN 1798-0054 (printed)
ISBN 978-952-245-750-9 (pdf)
ISSN 1798-0062 (pdf)

URN:ISBN:978-952-245-750-9
http://urn.fi/URN:ISBN:978-952-245-750-9

Juvenes Print – Finnish University Print Ltd
Tampere, Finland 2012

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To my family

Contents

List of Original Studies

This research project consisted of unpublished research and the following four studies:

I Järvelin J, Rosenqvist G, Häkkinen U, Sintonen H: Patient and hospital characteristics associated with claims and compensations for patient injuries in coronary artery bypass grafting in Finland. J Health Serv Res Policy 2009; 14 (3): 150–5.

II Järvelin J, Häkkinen U, Rosenqvist G, Remes V: Factors predisposing to claims and compensations for patient injuries following total hip and knee arthroplasty. Acta Orthop 2012; 83 (2): 190–6.

III Järvelin J, Häkkinen U: Can patient injury claims be utilised as a quality indicator? Health Policy 2012; 104 (2): 155–62.

IV Järvelin J, Häkkinen U, Rosenqvist G: Health care costs of patient injury claimants and non-claimants following common surgical procedures (submitted).

Abbreviations

CABG	Coronary Artery Bypass Graft Surgery
THA	Total Primary Hip Arthroplasty
TKA	Total Primary Knee Arthroplasty
DRG	Diagnostic Related Group

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Abstract

Jutta Järvelin. Studies on filed and compensated claims for patient injuries. National Institute for Health and Welfare (THL). Research 92. 164 pages. Helsinki. Finland 2012.
ISBN 978-952-245- 749-3 (printed), ISBN 978-952-245-750-9 (pdf).

According to a number of studies, patients' claims for compensation for a health-care-related injury consist of only a small and disproportionate sample of all the adverse events in health care and are therefore not an appropriate basis for conclusions regarding the total frequency or nature of all adverse events. Many claims are even argued to be groundless. Nevertheless, data on patient injury claims are relevant in solving diverse research questions that ultimately can contribute to improving the quality and patient safety of health care.

The overall aim of this research was to produce descriptive and analytical information on claims and compensations for patient injuries in Finland. The first specific objective was to identify factors that are associated with both the filing and compensating of claims. Another aim was to examine whether hospital claim rates are associated with the quality of care of these hospitals and whether they are feasible as a performance indicator. A further objective was to calculate the differential in health care costs between patient injury claimants and non-claimants. Finally, the research considered the strengths and weaknesses of the Finnish patient injury insurance scheme and made suggestions for its further development.

Data from the Finnish Patient Insurance Centre – the organization handling patient injury claims in Finland – were supplemented with data from other national health care registries. Descriptive information on claims and compensations was produced on specialized health care in Finland, whereas the more detailed analyses were carried out on data restricted to three surgical procedures: coronary artery bypass grafting (CABG), total primary hip arthroplasty (THA), and total primary knee arthroplasty (TKA). The statistical methods applied were logistic and multinomial logistic regression analyses, and generalized linear models.

Some patient groups were more inclined to file a claim than others. The elderly filed a claim less often than the non-elderly, though age did not generally affect a patient's chances of obtaining compensation. Male patients were less likely to file a claim than female patients but were more likely to obtain compensation for an injury involving an infection. Patients in a worse health state were more likely to file a claim than healthier patients, but contrary to the initial hypothesis, a worse health state did not reduce patients' chances of receiving compensation. An exception to this was injuries from CABG, for which patients in a worse health state were less likely to obtain compensation. Following THA, patients who had received a cement-

ed prosthesis were less likely to file a claim than patients with an uncemented prosthesis.

The research further established that a volume of over 300 operations of TKAs per year was associated with a decreased probability of compensation for certain injury types. Moreover, following both THA and TKA, hospital claim rates were positively associated with five-year revision and one-year deep infection rates.

The average risk-adjusted admission costs of compensated claimants and claimants denied compensation were higher than those of non-claimants. Nevertheless, the average costs of compensated claimants and claimants denied compensation did not differ from each other. Following CABG, the average risk-adjusted one-year health care costs increased with patients' claimant status, with non-claimants having the smallest costs, claimants denied compensation the second highest, and compensated claimants the highest costs.

The main implications of this research for improving patient safety and further developing the Finnish patient injury insurance scheme are: (1) Health professionals and policy-makers should give more consideration to patients' equal possibilities to file a claim and encourage them to pursue a claim when compensation seems justified. (2) The number of compensated patient injury claims following TKA may drop if TKAs are performed at larger hospitals. (3) Patient injury claims might be employable in performance measurement together with other indicators for monitoring treatment and surgical outcomes of selected patient groups. (4) The negligible differences in health care costs between compensated claimants and claimants denied compensation suggest that the care of claimants denied compensation has also involved substantial problems and that the claims of the latter are not groundless. Consequently, further study should focus on factors contributing to adverse events for both claimants receiving compensation and those denied compensation.

Key words: adverse event, patient injury, patient injury claim, compensation, coronary artery bypass grafting, arthroplasty

Abstract in Finnish

Jutta Järvelin. Studies on filed and compensated claims for patient injuries [Potilasvahinkoilmoituksia ja korvattuja vahinkoja käsitteleviä tutkimuksia]. Terveyden ja hyvinvoinnin laitos (THL). Tutkimus 92. 164 sivua. Helsinki 2012.
ISBN 978-952-245- 749-3 (painettu), ISBN 978-952-245-750-9 (pdf).

Tutkimus selvitti Potilasvakuutuskeskukselle tehtyjen vahinkoilmoitusten perusteella, mitkä tekijät vaikuttavat potilaiden aktiivisuuteen tehdä ilmoituksia ja heidän mahdollisuuksiinsa saada korvauksia sekä sitä, tekevätkö potilaat vahinkoilmoituksia perusteettomasti. Lisäksi tutkimus otti selvää, ovatko sairaaloista tehdyt vahinkoilmoitukset ja korvatut vahingot yhteydessä sairaaloiden hoidon laatuun ja voitaisiinko potilasvahinkoja kuvaavaa mittaria käyttää sairaaloiden suorituskyvyn mittaamisessa. Tutkimus arvioi myös Suomen potilasvahinkovakuutusjärjestelmän vahvuuksia ja heikkouksia.

Potilasvakuutuskeskuksen rekisteritietojen lisäksi tutkimusaineisto koostui terveydenhuollon muista kansallisista rekistereistä kootuista tiedoista. Tiedot rajattiin kolmeen kirurgiseen toimenpiteeseen, sydämen ohitusleikkaukseen sekä lonkan ja polven tekonivelleikkaukseen. Käytetyt tilastolliset menetelmät olivat logistinen ja multinomiaalinen logistinen regressioanalyysi sekä yleistetty lineaarinen malli.

Tutkimus osoitti, että tietyt potilasryhmät tekivät ilmoituksia aktiivisemmin kuin muut. Iäkkäämmät henkilöt tekivät vähemmän ilmoituksia kuin nuoremmat, mutta potilaiden ikä ei yleensä vaikuttanut heidän mahdollisuuksiinsa saada korvausta. Miehet tekivät ilmoituksia harvemmin kuin naiset, mutta miehet saivat naisia useammin korvauksen infektioon johtaneen vahingon seurauksena. Sairaammat potilaat tekivät ilmoituksen useammin kuin terveemmät, mutta tutkimus kumosi hypoteesin siitä, että sairaampien vahinkoja korvattaisiin vähemmän. Poikkeuksena oli sydämen ohitusleikkauksessa sattuneet vahingot, joita korvattiin harvemmin sairaammille potilaille. Perinteisen sementillisen lonkan tekonivelen saaneet potilaat tekivät ilmoituksen harvemmin kuin tätä uudemman sementittömän tekonivelen saaneet potilaat.

Edellä havaitut erot potilasryhmien välillä viittaavat siihen, että terveydenhuollossa pitäisi kiinnittää enemmän huomiota potilaiden tasavertaisiin mahdollisuuksiin hakea korvausta sekä kannustaa potilaita hakemaan korvausta tilanteissa, joissa tämä vaikuttaa perustellulta.

Tutkimuksessa havaittiin lisäksi, että sairaaloissa, joissa tehtiin yli 300 polven tekonivelleikkausta vuodessa, oli vähemmän korvaukseen johtaneita vahinkoja. Polven tekonivelleikkauksiin liittyvien korvattavien vahinkojen määrä saattaisi siis vähentyä, jos kyseiset leikkaukset keskitettäisiin suurempiin sairaaloihin.

Lonkan ja polven tekonivelleikkauksen jälkeen tehtyjen vahinkoilmoitusten ja -korvausten määrä oli yhteydessä viiden vuoden aikana leikkauksesta tehtyjen uu-

sintaleikkausten ja vuoden aikana ilmaantuneiden leikatun nivelen syvien infektioiden määrään. Tulos viittaa siihen, että tietoja vahinkoilmoituksista ja korvatuista vahingoista voitaisiin käyttää yhdessä muiden mittareiden kanssa joidenkin potilasryhmien hoidon tai leikkaustoimenpiteiden onnistumisen seurannassa.

Myönteisen tai kielteisen korvauspäätöksen saaneiden potilaiden leikkaushoitojakson kustannukset olivat keskimäärin suuremmat kuin potilaiden, jotka eivät tehneet ilmoitusta. Kuitenkaan myönteisen ja kielteisen korvauspäätöksen saaneiden potilaiden keskimääräiset kustannukset eivät poikenneet toisistaan. Tämä merkitsee sitä, että sekä myönteisen että kielteisen korvauspäätöksen saaneet potilaat käyttivät melko saman verran tai sisällöltään melko samanlaisia palveluja. Tämä puolestaan viittaa siihen, että kummassakin ryhmässä oli yhtä paljon tai yhtä vaikeita haittatapahtumia.

Sen sijaan ohitusleikattujen potilaiden leikkausta seuranneen vuoden aikana terveyspalvelujen käytöstä syntyneet kustannukset vaihtelivat potilasryhmittäin: kielteisen korvauspäätöksen saaneiden potilaiden yhden vuoden kustannukset olivat keskimäärin suuremmat kuin potilaiden, jotka eivät olleet tehneet ilmoitusta; myönteisen korvauspäätöksen saaneiden yhden vuoden kustannukset olivat keskimäärin suuremmat kuin kielteisen korvauspäätöksen saaneiden potilaiden. Tämäkin tulos viittaa siihen, että kielteisen korvauspäätöksen saaneiden potilaiden hoidossa on ollut ongelmia ja että he eivät ole hakeneet korvausta turhaan.

Tutkimuksen tuloksia voidaan hyödyntää terveydenhuollon laadun ja potilasturvallisuuden edistämisessä. Mikäli haittatapahtumien syitä tutkitaan potilasvahinkoilmoitusten perusteella, pelkästään myönteisen korvauspäätöksen saaneiden potilaiden haittatapahtumien syiden selvittäminen ei riitä vaan pitää tutkia myös kielteisen korvauspäätöksen saaneiden potilaiden haittatapahtumiin johtaneita tekijöitä.

Avainsanat: haittatapahtuma, potilasvahinko, vahinkoilmoitus, korvaus, sydämen ohitusleikkaus, tekonivelleikkaus

Abstract in Swedish

Jutta Järvelin. Studies on filed and compensated claims for patient injuries [Studier om anmälningar om och ersättningar för patientskador]. Institutet för hälsa och välfärd (THL). Forskning 92. 164 sidor. Helsingfors, Finland 2012.
ISBN 978-952-245- 749-3 (tryckt), ISBN 978-952-245-750-9 (pdf).

I undersökningen utreddes utgående från Patientförsäkringscentralens skadeanmälningar olika faktorer som påverkar patienternas benägenhet att anmäla, deras möjligheter att få ersättning samt om patienterna gör onödiga anmälningar. Dessutom klarlades huruvida de skadeanmälningar som gjorts av sjukhusen samt de ersatta skadorna har något samband med vårdkvaliteten på sjukhusen, och om det skulle vara möjligt att använda ett mätinstrument som beskriver patientskador vid mätning av sjukhusens prestationsförmåga. I undersökningen bedömdes även de starka och svaga sidorna i det finländska patientförsäkringssystemet.

Materialet för studien bestod av registeruppgifter från Patientförsäkringscentralen samt ur andra nationella register inom hälso- och sjukvården. Uppgifterna begränsades till tre kirurgiska ingrepp, kranskärlsoperation eller s.k. bypass, samt höft- och knäprotesoperationer. De statistiska metoderna var logistisk och multinomial logistisk regressionsanalys samt en generaliserad linearisk modell.

Vissa patientgrupper var mer aktiva i att göra skadeanmälningar än andra. Äldre personer gjorde färre anmälningar än yngre, men patienternas möjligheter att få ersättning påverkades i allmänhet inte av deras ålder. Män anmälde mer sällan än kvinnor, men fick oftare än kvinnor ersättning för skada som lett till infektion. Sjukare patienter gjorde oftare patientanmälan än friskare, men undersökningen vederlade delvis hypotesen om att de sjukare patienterna mer sällan skulle få ersättning för sina skador. Ett undantag var skador som inträffat under bypass-operation, vilka mer sällan ersattes för de sjukare patienterna. Patienter som fått en cementerad höftprotes gjorde mer sällan en anmälan än patienter med ocementerad protes.

De ovan relaterade skillnaderna mellan olika patientgrupper tyder på att man inom hälso- och sjukvården bör fästa större vikt vid att patienter har lika möjligheter att ansöka om ersättning och att de uppmuntras att ansöka i sådana fall där det kan anses vara motiverat.

Undersökningen visade också att sjukhus med fler än 300 knäprotesoperationer per år hade ett mindre antal patientskador som lett till utbetalning av ersättning. Antalet ersatta patientskador i samband med knäprotesoperationer skulle alltså möjligen minska om dessa operationer endast utfördes på de största sjukhusen.

Det förelåg ett samband i fråga om skadeanmälningar och -ersättningar efter höft- och knäprotesoperationer i relation till antalet reoperationer som gjorts inom fem år räknat från den första operationen samt djupa infektioner som uppstått inom ett år i den opererade leden. Resultatet tyder på att uppgifter om skadeanmäl-

ningar och ersatta skador skulle kunna användas vid sidan av andra mätinstrument för uppföljning av vårdresultaten och utfallet av operativa ingrepp när det gäller vissa patientgrupper.

Kostnaderna för vårdperioder för de patienter som antingen fått ersättning eller som fått ett nekande ersättningsbeslut var i genomsnitt högre än kostnaderna för patienter som inte hade gjort anmälan. Däremot förekom det inga skillnader i de genomsnittliga kostnaderna mellan patienter som fått positivt respektive negativt ersättningsbeslut. Detta innebär att patienterna, oavsett positivt eller negativt ersättningsbeslut, anlitade ungefär lika mycket vårdtjänster eller tjänster med likartat innehåll. Detta för sin del tyder på att det i bägge grupper fanns lika många eller lika svåra negativa händelser.

Däremot varierade kostnaderna enligt patientgrupp vad gäller anlitade vårdtjänster under ett år efter genomförd bypass-operation: ett års kostnader för patienter som fått negativt ersättningsbeslut var i medeltal högre än kostnaderna för patienter som inte gjort anmälan. Däremot var ett års kostnader för patienter som beviljats ersättning i medeltal högre än kostnaderna för patienter som fått negativt ersättningsbeslut. Även detta resultat tyder på att problem har förekommit i vården och behandlingen av de patienter som fått negativt ersättningsbeslut och att de inte har ansökt om ersättning i onödan.

Resultaten av studien kan utnyttjas i arbetet för en bättre kvalitet och patientsäkerhet inom hälso- och sjukvården. Om orsakerna till negativa händelser studeras utgående från det material som består av skadeanmälningar räcker det inte med att klarlägga orsakerna endast i fråga om patienter som fått positivt ersättningsbeslut. Man bör också studera faktorer som lett till negativa händelser i de fall där patienterna inte fått någon ersättning.

Nyckelord: negativ händelse, patientskada, skadeanmälan, ersättning, bypassoperation, ledprotesoperation

1 Introduction

The main types of systems established for processing patients' claims for compensation for a health care-related injury are tort and no-fault. A tort system is in operation in the United States and Great-Britain, while New Zealand and the Nordic countries have adopted a no-fault system. The primary task of both tort and no-fault systems is to determine whether patients' claims are eligible for compensation as well as the amount of monetary compensation. Another task of tort systems is to penalize providers for any wrongdoing and act as an incentive for them to devote sufficient effort to the prevention of adverse events (Danzon 2000). This prevention task is less clear in no-fault systems, because patient claims do not imply direct consequences for individual health professionals, such as having a lawsuit filed against them. Nevertheless, incentives for adverse event prevention may be present also within no-fault systems, for instance, in the form of financial incentives in situations in which hospitals or other health care organizations have to finance compensation payments for their own injuries and, consequently, have an interest in investing in patient safety. Furthermore, on the side of no-fault systems, other kinds of incentives for adverse event prevention usually exist, such as the threat of disciplinary procedures initiated by health authorities.

Research on the performance of patient injury compensation schemes has so far been predominantly advanced in the United States. There, it seems the tort system can fairly well distinguish whether the patient's care was substandard or not (Cheney et al. 1989, Sloan and Hoerger 1991, Farber and White 1994, Studdert et al. 2006) and determine the size of compensation according to the injury severity or the presence of error (Cheney et al. 1989, Taragin et al. 1992, Studdert et al. 2006). The system, however, has been criticized as being highly inefficient. The processing of claims is lengthy and from 54% to 60% of the system's total expenditures are spent on administration, such as lawyer and other expert fees (Danzon 2000, Studdert et al. 2006). Nevertheless, determining whether a tort system is better or worse than a no-fault scheme is not possible, because no-fault schemes have been subject to much less research than tort systems.

Patients file a claim for compensation only rarely, even though adverse events from health care are very common. Adverse events occur in about 10% of inpatient admissions (de Vries et al. 2008) and, despite precise epidemiological data being unavailable, are probably frequent also in outpatient care (Gandhi et al. 2006, Woods et al. 2007). In contrast, only from 0.1% to 0.2% of inpatients (Localio et al. 1991, Studdert et al. 2000, Christoffersen and Holm-Nielsen 2004, Bismark et al. 2006b, Pukk-Härenstam et al. 2008), and from 1% to 3% of inpatients with a (theoretically) compensable adverse event file a claim (Localio et al. 1991, Studdert et al. 2000, Christoffersen and Holm-Nielsen 2004, Bismark et al. 2006b). The claim frequencies do not fundamentally differ between tort and no-fault systems.

It is presumable that the small group of patients who file a claim due to an adverse event are not a representative sample of the large set of all patients with adverse events or that the nature of the adverse events of the former would be a representative sample of that of the latter group (Vincent et al. 2006). For instance, the age of patients, severity of adverse events, and other characteristics of patient care are known to differ between adverse events in claims and adverse events in general (for instance, Sloan and Hsieh 1995, Studdert et al. 2000, Davis et al. 2003, Bismark et al. 2006b, Dunbar and Sabry 2007). Further distortion of the claims sample derives from the fact that a proportion of claims do not entail any adverse events, which according to some studies is from less than 10% to 60%, of which nevertheless a fraction receives compensation (Brennan et al. 1996, Studdert et al. 2000, Studdert et al. 2006).

Despite their low frequency and the poor representativeness of adverse events, patient injury claims are worth studying. Investigations of claims can disclose strengths and weaknesses of the patient injury compensation scheme and lead to suggestions for its further improvement. Moreover, claims can reveal patient perspectives on adverse events in a way that other information sources are not able to (Vincent et al. 2006). For instance, previous studies have brought to light inequities between patient groups. Low-income, ethnic minorities, and, as already mentioned, elderly persons file for compensation less often than middle-aged persons and persons with higher income (Burstin et al. 1993, Studdert et al. 2000, Pukk et al. 2003, Bismark et al. 2006b).

A further motivation for studying claims is that analysing factors associated with claims might expose factors that also play a role in the occurrence of adverse events in general. Factors that contribute to adverse events are probably not any different from those factors that cause adverse events eventually resulting in claims (Regenbogen et al. 2007). Since claims often involve more severe adverse events (May and Stengel 1990, Sloan and Hsieh 1995, Studdert et al. 2000, Bismark et al. 2006b, Dunbar and Sabry 2007), analysing claims may help to prevent in particular factors that bring about more severe adverse events.

Enhancing the utilisation of information obtainable from claims for preventing adverse events is currently even more vital, as worldwide activities to improve patient safety have shown that advancing patient safety is perhaps more complex and time-consuming than initially anticipated (Landrigan et al. 2010, Leistikow et al. 2011).

Measuring patient safety is not easy. Some of the reasons are that adverse events are occasionally difficult to recognise, their origins are often complicated, some adverse events are detectable only after a time lag, some are mistakenly viewed as part of the patient's health problem, and sometimes, it may be unclear whether an adverse event occurred at all (Leistikow et al. 2011). These all highlight the need to utilise a combination of different indicators from different sources when measuring patient safety (Naessens et al. 2009, Levtzion-Korach et al. 2010).

Despite the difficulties, patient safety measurement has been the subject of a number of national and international initiatives (Klazinga et al. 2011). For instance, the Organization for Economic Cooperation and Development (OECD) has worked out - on the basis of indicators originally elaborated by the United States's Agency for Healthcare Research and Quality (AHRQ) - a range of patient safety indicators (Drösler et al. 2012). A selection of these was published for individual countries for the first time in the OECD Health at a Glance –report of 2011 (OECD 2011). Furthermore, the Nordic countries have launched their joint quality and patient safety initiatives, which has involved co-operation with the OECD projects on quality and patient safety (Gissler et al., forthcoming).

Utilisation of the OECD patient safety indicators remains problematic, however. Indicator values obtained from different countries have correlated with the number of reported secondary diagnoses – precisely the codes that are crucial for the construction of the indicators (Drösler et al. 2012). This has meant that the rate of patient safety incidents as measured by the indicators has not reflected the true rate of incidents but rather the degree to which health care systems register secondary diagnoses. The insufficient registering of secondary diagnoses at hospitals and health centres is a problem also in Finland and hampers utilisation of the OECD patient safety indicators for regional comparisons within this country (Gissler et al., forthcoming).

Due to the above described challenges and the length of time that might be needed to achieve improvement in the registering of secondary diagnoses, finding a range of additional patient safety indicators would be valuable.

Whether patient injury claims might be an additional indicator and usable for measuring care quality and patient safety is not known. Neither is it known whether an indicator measuring the claim rates of hospitals and other health care organizations would fulfil all of the properties required of a performance indicator. If this was the case, claims would be a helpful addition to the current collection of quality and patient safety indicators.

Further notable rationales for studying patient injury claims are the huge costs of adverse events (Øvretveit 2007). These consist of costs imposed on the health care system from the treatment of adverse events as well as costs imposed on the remainder of society, such as lost household production and income loss (Johnson et al. 1992, Thomas et al. 1999). Additional costs emerge from the consequences of adverse events that are difficult to express in monetary terms. These comprise costs imposed on patients and their relatives in terms of grief, worries, and other kinds of distress as well as on health professionals in terms of time and effort in processing an adverse event and also their various feelings of pressure, guilt, and being inadequate (Runciman and Moller 2001). In consequence, the prevention of adverse events might bring society significant monetary and nonmonetary savings. Whether such savings would be achievable from adverse events that generate claims has not been studied before, but is likely to be the case.

Particularly in Finland, the need to obtain more information on adverse events and patient safety is great. Epidemiological studies on adverse events have not taken place in this country and the number of studies that have utilised patient injury claims data is limited. Such studies have investigated, among other things, the attitudes of health care personnel towards the filing of patient injury claims as well as health service utilisation following wound infections (Hyrylä 1993, Hyrylä and Sintonen 1994). Others have described the frequencies, nature, causes, and consequences of injuries apparent in claims related to inguinal hernia surgery, as well as diagnostics and treatment of ankle fractures and children's fractures (Hirvensalo et al. 2009, Palmu et al. 2009, Paajanen et al. 2010, Palmu et al. 2010).

Further in regard to Finland, the growth in the number of measures to promote patient safety in recent years has been rapid. In 2009, the Ministry of Social Affairs and Health launched a national strategy that aims, among others, to enhance the patient safety culture and bring about the inclusion of patient safety in the everyday practices of health care provider organizations (Ministry of Social Affairs and Health 2009). The national strategy has continued and is further concretised in the national Patient Safety with Skills –programme, supported by the National Institute for Health and Welfare and endorsed by a published guide on patient safety ("National Institute for Health and Welfare" 2012). Moreover, in 2011, patient safety became an essential part of the Health Care Act and the Statute on patient safety and quality control, which include several items relating to patient safety and the quality of health services, including the obligation for each health care organization to draw up a plan on the implementation of patient safety measures (Health Care Act 2010, Ministry of Social Affairs and Health 2011). Apart from these national measures, some hospitals have launched their own patient safety initiatives, such as the adoption of incident reporting systems (Ruuhilehto et al. 2011). In spite of these numerous activities, data systems for monitoring patient safety in Finland are inadequate, as is the scientific research related to patient safety.

The overall aim of this current research was to produce descriptive and analytical information on patient injury insurance in Finland. The first specific objective was to analyse patient- and hospital-level factors associated with filed and compensated claims. Such analyses might reveal potential inequities in patients' possibilities to file a claim and obtain compensation as well as produce information on factors predisposing to claims, and therefore, possibly to adverse events.

A further aim was to assess whether the claim rates of hospitals are associated with the quality of care of these hospitals and whether an indicator measuring the claim rates would possess all the features expected of a performance indicator. If an association with quality was found and if a claims indicator possessed all of the required features, claims would be feasible for measuring performance and assessing the effect of patient safety initiatives. This would bring valuable additional information, particularly given the challenges in measuring patient safety and the shortcomings in the current quality and patient safety indicators.

Finally, the research aimed to fill one gap present in previous research: the lack of information regarding the health care costs of patient injury claimants as compared to non-claimants. Compensated claimants presumably would have significantly higher health care costs than non-claimants and claimants denied compensation, because compensated claimants are likely to have suffered from more serious adverse events than the other two patient groups. Moreover, that the claims of claimants denied compensation were unsuccessful suggests that their adverse events were mild or that they did not suffer any adverse events at all.

Information on the cost differentials between the three claimant groups can serve various purposes. Health services managers and financiers of care can use such information in budget planning and resource allocation in situations in which patients have initiated claims. Furthermore, monitoring changes in cost differentials between claimant groups can assist in observing the success of patient safety initiatives, because a change in the differentials may point to a change in the frequency or severity of adverse events. Finally, the size and statistical significance of the cost differentials between the claimant groups will indicate whether the claims of claimants denied compensation are really unfounded. Such claims are unlikely to be groundless if the costs of claimants denied compensation are significantly larger than those of non-claimants, and especially if the costs of the former are at least equal to those of compensated claimants.

The research project comprised four studies as well as unpublished research. These are summarized in this report according to the following structure: Chapter 2 presents key terms related to patient injury claims and a description of the patient injury insurance scheme in Finland. Chapter 3 comprises a presentation of the theoretical framework and a literature review of previous empirical studies on claims and compensations. Chapter 4 describes the aims of the research. Chapter 5 presents the data and methods used, including the linking of datasets. Chapter 6 summarizes the main results. Chapter 7 comprises a discussion with suggestions for further research and further development of the Finnish patient injury insurance scheme. Finally, Chapter 8 contains the conclusions.

2 Patient injury insurance in Finland

2.1 Key terms

The Finnish patient injury insurance scheme has been referred to in this research as a "no-fault" scheme (often with the addition of "no-blame") for the sake of simplicity and due to the frequent usage of no-fault in the published literature for compensation schemes operating separately from the courts (Danzon 2000, Bismark et al. 2006b). Furthermore, no-fault can be understood to mean that an individual health professional is not held financially or legally liable for a fault made apparent in a patient's claim. Nevertheless, it has been a criticism within the public discourse in Finland that no-fault would not be an accurate description of the Finnish scheme, because patient injury claims often do involve errors or fault; this same argument has also been raised in regard to the scheme in Sweden (Pukk-Härenstam et al. 2008). Consequently, some authors have described the Finnish scheme as one that stands "between negligence liability and strict liability, a no-blame scheme" (Mikkonen 2007). Thus, in principle no-fault and no-blame refer to the same kind of system, but by using "no-blame" one recognizes that someone may be at fault for a patient's injury or that the patient's care involved fault, but that one does not blame a person for that fault.

A solution to the mixed terminology would be to use the term "administrative" scheme, as used in studies on the compensation schemes in Sweden, Denmark, and New Zealand (Kachalia et al. 2008, Pukk-Härenstam et al. 2008).

The term "malpractice" is commonly applied in connection with tort systems, but it is unclear whether the term is suitable for no-fault systems. For instance, a study on injury claims in Sweden applied this term (Pukk et al. 2003), while another study used the term as a synonym for negligence (Mello and Hemenway 2004).

Further key terms utilized throughout this research appear in Table 1. The table does not list all of the different definitions available for individual terms. For instance, various definitions exist for an adverse event. An adverse event is, according to the World Health Organization, an "incident which resulted in harm to a patient" (WHO 2009), while Brennan et al. (1991a) defined it as an "injury caused by medical management (rather than the underlying disease) that prolonged the hospitalization, produced a disability at the time of discharge, or both." An adverse event that resulted in a claim for compensation is called in Finnish terminology a "patient injury" (Glossary on Patient Safety 2007).

Table 1. Terminology related to patient injury claims.

Source	Term	Definition
WHO (2009)	Adverse event	"Incident which resulted in harm to a patient (harmful incident)"
WHO (2009)	Injury	"Damage to tissues caused by an agent or event"
Mello and Hemenway (2004)	Claim	"A demand for payment"
Sloan and Hsieh (1995)	Negligence	"Failure to meet the standard of customary care"
WHO (2009)	Error	"Failure to carry out a planned action as intended or application of an incorrect plan"
WHO (2009) Mello and Hemenway (2004)	Malpractice	"Failure of care or skill by a professional that causes loss or injury and results in legal liability" "Negligence"
Douglas (2009) (adapted)	Tort system	"Court-based system"…, "in which the victim of an injury is awarded compensation, paid by the injurer, only if she can establish that the injurer in question was *at fault for her injury*"
Kessler et al. (2006)	No-fault scheme	"A system that uses an administrative system rather than the courts to compensate injuries independent of provider negligence or fault"
WHO (2009)	Patient safety	"The reduction of risk of unnecessary harm associated with healthcare to an acceptable minimum"

2.2 The health care system in Finland in brief

The entities that primarily organize and finance health services in Finland are the 336 municipalities. Municipalities organize primary health care at health centres, while organization and co-ordination of specialised health care occurs via the 20 hospital districts (with the Åland Islands consisting of an additional hospital district on its own). Hospital districts are federations of municipalities that typically contain from one to three hospitals providing both inpatient and outpatient specialised health care. Financing of hospital care comes from payments by municipalities that are individually responsible for the costs of the care of their inhabitants according to the usage of services (with the exception of very expensive treatments for which hospital districts have adopted equalization mechanisms). Municipalities finance both primary and specialized health care out of user charges, subsidies allocated by the state, and their own tax revenue.

Alongside the public system that is reliant on the municipalities is the National Health Insurance scheme operated by the Social Insurance Institution. It reimburses part of the costs of private and occupational health care, pharmaceuticals, and a range of other services.

2.3 Organization of patient injury insurance in Finland

The patient injury insurance scheme in Finland has been in operation since 1987. It has allowed patients to claim for compensation for a health-care-related injury from the Patient Insurance Centre, which was named Patient Insurance Association at its inception, without the need to resort to a possibly cumbersome legal process through a court. As a result, currently only about 20 lawsuits related to health care are filed with the courts in Finland per year, while almost all patient claims for compensation are handled by the Patient Insurance Centre (Palonen et al. 2005).

The number of claims filed with the Patient Insurance Centre remained close to 7000 over several years until 2000. Thereafter, the number increased steadily, reaching 8000 filed claims in 2006. In 2009, the number of claims had reduced again close to 7000, but increased again to 7708 in 2011 ("Patient Insurance Centre" 2012). What proportion this 7000 to 8000 claims constitutes of all adverse events in health care practice in Finland is not possible to determine because of the absence of studies on the frequency of adverse events in this country. Furthermore, relating the overall number of claims to the overall number of hospital admissions in Finland is problematic, because admissions registered within the national Hospital Discharge Register concern care at very different types of provider organizations, ranging from university hospitals to long-term care institutions; the content of an admission and the risk of an adverse event and claim at the different institutions can vary greatly. Moreover, some claims may concern outpatient care so that the total number of claims cannot be related to inpatient admissions alone.

The Patient Insurance Centre is a consortium of private insurance companies (nine in 2012) that has been supervised and instructed since 2009 by the Financial Supervisory Authority, with the Ministry of Social Affairs and Health determining the rules regarding the Centre (Patient Injury Act 1985). Its main tasks are to judge whether the patient's claim qualifies for compensation, to define the amount of compensation, and to handle the monetary flows of compensation payments.

The compensation of patient injuries and patient injury insurance in general falls mainly under the Patient Injury Act. According to the Act, the patient may receive compensation if her injury matches one of seven criteria: 1) treatment injury, 2) infection injury, 3) accidental injury, 4) injury from a deficient device, 5) injury from damages to premises or equipment, 6) injury from incorrect delivery of pharmaceuticals, and 7) unreasonable injury. In addition to these criteria, the Pa-

tient Injury Act describes other prerequisites for compensation. The most notable of these are that the patient suffered an injury and that this injury was very probably or probably caused by the health or medical care provided. Furthermore, the injured person must be a patient and the injury must have occurred in Finland after 1 May 1987 (Palonen et al. 2005). The time within which patients must file their claim with the Patient Insurance Centre is three years from their injury or, in exceptional cases, ten years.

A treatment injury qualifies for compensation if an experienced health professional would have acted differently in providing treatment compared to the actual treatment the patient received, such that it would have prevented the injury. In contrast, the compensability of an infection injury is based on tolerability. This means that the patient should not have had to endure the infection, which is assessed on the basis of the patient's medical history and existing health status, on the treatment given and on its related risks. The remaining five criteria each have their own definition.

A common statement concerning no-fault schemes is that, unlike tort systems, these schemes do not demand proof of negligence. If negligence is understood to mean that the patient's care did not reach "the standard of customary care" (Sloan and Hsieh 1995), this definition is the same or at least very close to the definition of treatment injury in Finland. In addition to negligence, two other prerequisites have to be fulfilled in a tort system if a health professional is to be judged legally responsible for an injury: the patient must have been injured and there must be a causal relationship between the injury and the patient's health or medical care (Sloan and Hsieh 1995). These two criteria are also prerequisites for a compensable injury in Finland, as the patient in Finland must have suffered an injury and the injury must have been probably or very probably caused by health or medical care.

However, given that the compensation criteria allow for compensation for reasons other than just the standard of an experienced health professional, it is clear that injury compensation in Finland is based on more wide-ranging grounds than the compensation of injuries in a tort system, a view expressed with respect to the no-fault schemes in the Nordic countries and New Zealand (Kachalia et al. 2008).

Over the years, the number of compensated claims as a share of filed claims in Finland has stayed at around 30%. About a quarter of compensated claims concern care provided by the private sector and the remainder the public sector ("Patient Insurance Centre" 2012). However, about 90% of compensations in money terms are payable for injuries in the public sector ("Patient Insurance Centre" 2012). About 90% of compensated claimants receive compensation because of a treatment injury and nearly 10% because of an infection injury. Only rarely are the other five criteria used as a justification for compensation. However, the distribution of the seven criteria for compensation may vary across surgical and medical treatment procedures.

When considering a claim's eligibility for compensation, the Patient Insurance Centre in its decision-making utilizes a patient's medical records, radiographs, accounts given by the provider involved in the injury, statements by independent

medical experts as well as other necessary documents. In addition, the Centre may consider the entire treatment process of the patient and the functioning of the organization of patient services in overall terms, which can be seen as a major difference to tort systems (Palonen et al. 2005).

Some years after of the introduction of the Patient Injury Act, it became apparent that the definitions for some of the seven criteria were problematic (Palonen et al. 2005). In particular, difficulties were perceived in judging the compensability of infection injuries. An infection injury had originally qualified for compensation if the infection was preventable. Preventability was assessed on the basis of the risk of an infection, i.e. if patient's risk of an infection was low she received compensation, whereas if her risk of an infection was high, she did not receive any compensation. This led to a situation in which many mild infections were eligible for compensation and many severe infections were not (Palonen et al. 2005). Subsequently, on the 1st May 1999, an amendment to the Patient Injury Act took effect and the underlying principle for the compensation of infection injuries became tolerability, as described above.

Another noteworthy amendment to the Patient Injury Act in 1999 was the change in the definition of an unreasonable injury. It had been compensable prior to the amendment only in cases where the injury originated from the conduct of medical research, but after the amendment, actual health and medical care became eligible situations for compensation for an unreasonable injury. In other words, a patient would receive compensation if she had suffered a severe injury that led to permanent harm or death and was unpredictable from the perspective of her illness and health status in general and the health or medical care given (Palonen et al. 2005).

If a claimant is not content with the Patient Insurance Centre's decision regarding the compensability of her claim or the size of the compensation payment, she has various options to proceed (Figure 1). In cases where the claimant can provide new information that might alter the Patient Insurance Centre's decision, she can ask the Centre to re-evaluate her case. Another option is to request a recommendation concerning her case from the Patient Injuries Board. The Board is an independent expert group consisting of lawyers, physicians and other professionals that issues recommendations and statements with the primary aim of unifying practices related to the compensation of patient injuries ("Patient Injuries Board" 2012).

The bulk of the roughly 1000 requests for a recommendation processed by the Patient Injuries Board per year come from patients, while a minority are initiated by health professionals and the Patient Insurance Centre ("Patient Injuries Board" 2012). The Patient Insurance Centre usually adheres to the recommendations made by the Board. In addition, courts may ask the Board for a statement regarding cases they process.

A further option for a patient dissatisfied with the Patient Insurance Centre's decision is to file a lawsuit against the Patient Insurance Centre.

Alongside her claim for compensation, the patient may issue a complaint to the administration of the health care organization she was treated at, the Regional State Administrative Agencies, or the National Supervisory Authority for Welfare and Health "Valvira". The Parliamentary Ombudsman and the Chancellor of Justice also handle complaints concerning public authorities as well as physicians, nurses, and other health professionals in the public sector.

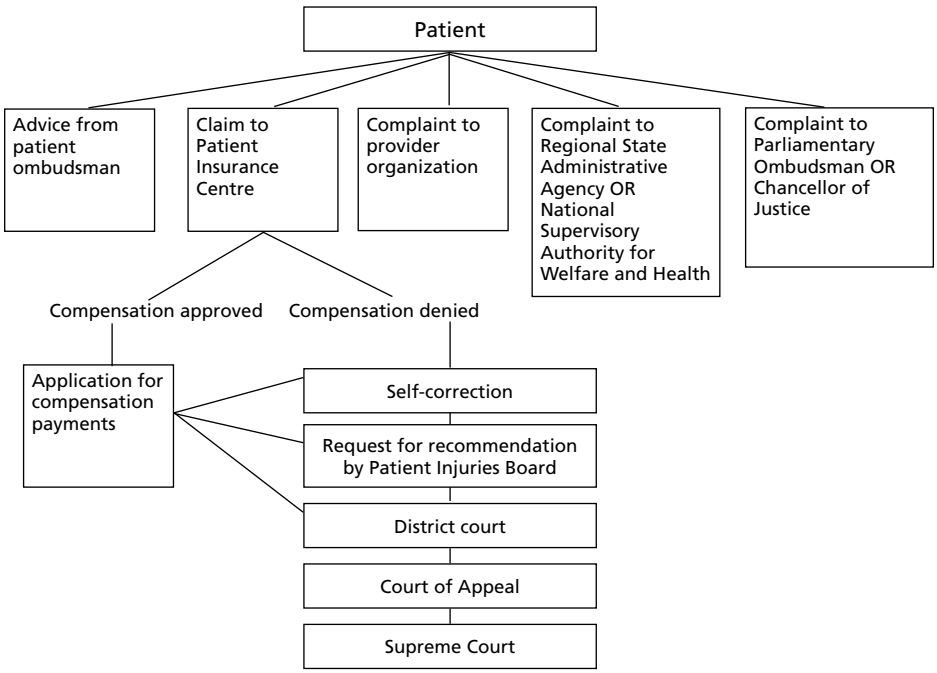

Figure 1. Main alternatives for patients to complain and claim compensation in Finland.

The Patient Insurance Centre processes claims related to all kinds of health care, but it does not process claims related to unexpected side effects of pharmaceuticals. Such claims may be submitted to a separate scheme, the Finnish Mutual Insurance Company for Pharmaceutical Injury Indemnities.

Although patient ombudsmen at health care provider organizations operate independently from the patient injury insurance scheme, they need to be mentioned because of their possible significant influence on patients' decisions to file a claim. Their influence may derive from the patient ombudsman actively informing patients about their rights or from the ombudsman's encouraging or discouraging attitudes while assisting patients in preparing complaints or filing of claims. There are no data, however, as to the extent to which the patient ombudsmen affect patients' decisions to file a claim. Overall, such an effect might be of minor significance given that the patient ombudsmen have discussions with only some of the patients that

file a claim. According to a survey, about 60% of the surveyed patient ombudsmen in the public sector estimated that less than half of patient contacts with an ombudsman resulted in a claim to the Patient Insurance Centre, while about 40% of the surveyed ombudsmen estimated that more than half of such contacts resulted in a claim (Aho 2004).

Age- and sex-adjusted rates of filed claims vary greatly between hospital districts (Figure 2). In general, however, those districts with a high rate in 1998 had also the highest rate in 2007 and those districts with a low rate of claims maintained their relatively low rates throughout the time period. Nevertheless, the variation in claim rates seemed to reduce to some extent from 1998 to 2007. In 1998, the lowest age- and sex-adjusted filed claim rate in a single hospital district was 25% lower than the national average and the highest rate 107% higher than the national average, while in 2007, the corresponding figures were 28% and 52%, respectively.

Rates of age- and sex-adjusted compensated claims seem to vary across hospital districts even more than rates of filed claims (Figure 3). However, rates seemed to be converging in 1999 before diverging again after 2001. This might reflect the amendment to the Patient Injury Act in 1999 and the subsequent reduction in the overall number of compensated infection injuries. For instance, the highest age- and sex-adjusted compensated claim rate within a hospital district was 150% higher in 1998, 53% higher in 2000, and 84% higher in 2007 than the national average, while the corresponding lowest rate was 28% lower in 1998, 37% lower in 2000, and 36% lower in 2007 than the national average.

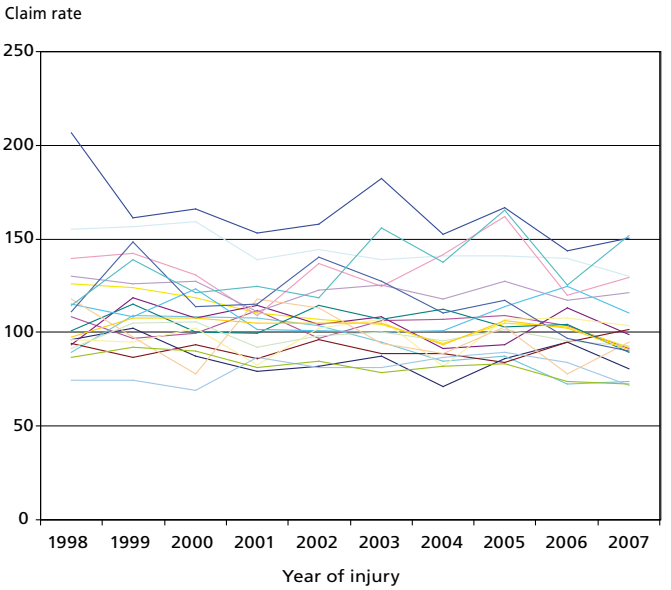

Figure 2. Age- and sex-adjusted rates of claims concerning injuries that occurred in public health care within hospital districts in Finland between 1998 and 2007 (one line represents one hospital district's area, national average=100).

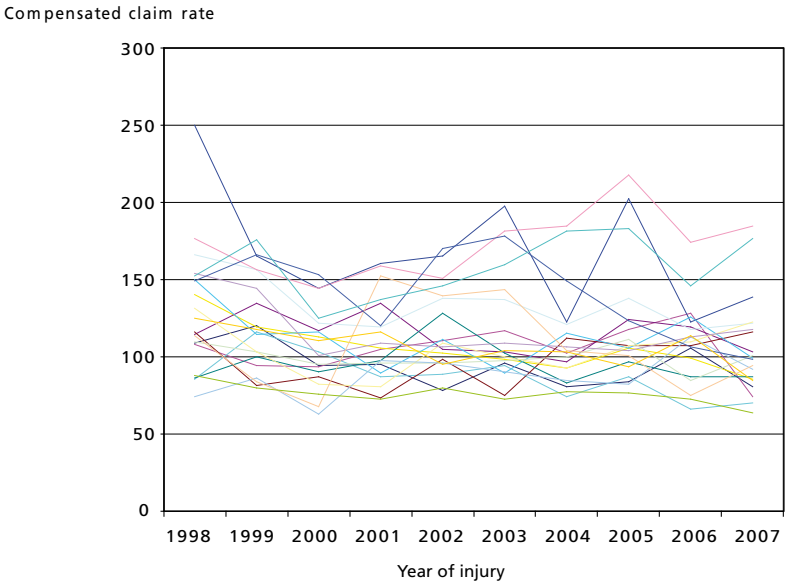

Figure 3. Age- and sex-adjusted rates of compensated claims concerning injuries that occurred in public health care within hospital districts in Finland between 1998 and 2007 (one line represents one hospital district's area, national average=100).

Figure 4 displays the number of compensated claims as a share of all claims between 1998 and 2007 by hospital districts. The compensation rate for most districts seems to have stayed rather close to 30%, but rates seem to have diverged slightly towards 2007.

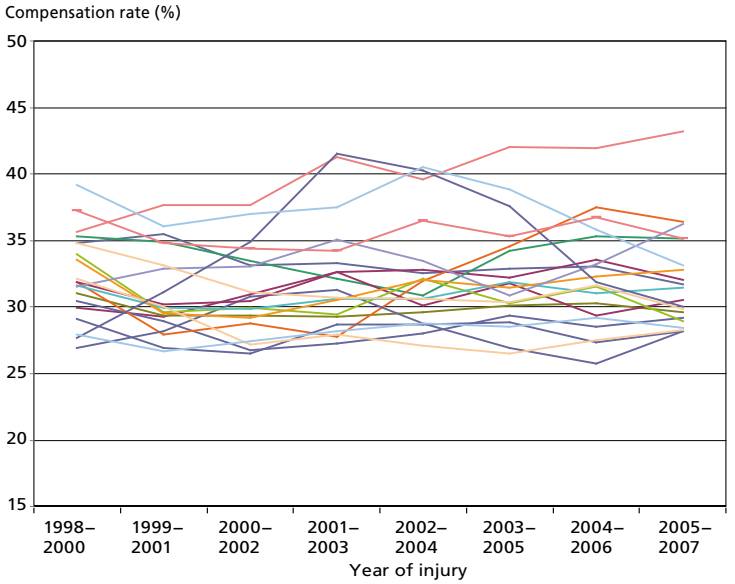

Figure 4. Compensated claims as a share of all claims by hospital districts in Finland between 1998 and 2007 (one line denotes one hospital district's area; 3-year sliding average).

2.4 Compensation payments and insurance premiums in Finland

If the Patient Insurance Centre determines a claim to be eligible for compensation, compensation is payable for health care costs the patient incurred from treating her injury, for instance, user charges for outpatient and inpatient care at hospitals and health centres well as for medications. Furthermore, the Patient Insurance Centre pays for income loss (for instance, in terms of pensions), temporary or permanent damage such as pain and cosmetic injury, burial costs, and other costs encountered by the patient from the injury depending on the size and nature of her losses.

The Patient Insurance Centre does not reimburse any costs incurred by the health care provider in treating patient injuries. Consequently, the majority of the costs arising from adverse events, whether these produce a claim or not, are borne by the health care system, and therefore, in the end, mainly by the state and the municipalities.

The amounts of monetary compensation follow the norms and principles outlined by the Tort Liability Act and the Traffic Accident Board in Finland. The Board has defined, for instance, the size of a compensation payment for a mild and temporary injury to an adult as being between EUR 200 and 1000, whereas that for a permanent injury of medium severity to be between EUR 23 100 and 26 400 (in 2011) (Traffic Accident Board 2010). Compensation can be paid as a lump sum (immaterial costs such as pain), on a monthly basis (pensions), or as costs accrue to patients (for instance, costs of health care).

Compensation paid to patients represents the net costs to patients from patient injuries, since these are the left-over of costs patients have not been compensated for by other agencies. Other funding sources may, for instance, compensate patients for income loss, in which case the Patient Insurance Centre deducts such compensations from payments paid as patient injury compensation.

The distribution of compensation payments between compensated claimants is highly skewed. For instance, with regard to claimants who qualified for compensation between 1996 and 2000, 0.1% of compensated claimants received 9% of the total amount of compensations and 1.1% of compensated claimants received 38% of the total amount. Obviously, the 0.1% and 1.1% of claimants were patients with the most severe injuries (Särkämö 2001).

The total costs of patient injury insurance have been around EUR 30 million per year (EUR 31 million in 2009) excluding provisions for future payments. This corresponds to a sum that is less than 1% of total health care spending in Finland and consists of expenses for health care, rehabilitation and other similar expenses (23% in 2009), income loss (25%), immaterial costs such as temporary and permanent harm (31%), and administrative costs (21%) ("Patient Insurance Centre" 2012).

If compensation payments are viewed on the basis of the year of the occurrence of the injury, then the amounts of compensation payments vary somewhat

from year to year (Figure 5). This variation may in part be due to the variation in the number and/or severity of injuries and in part due to variation in income losses, for instance, due to changes in the numbers of patients with different incomes. In contrast, the large variation in provisions for future payments derives in particular from the difficulties in estimating compensations for health care utilization, income losses, and other expenses in the future (Särkämö 2001).

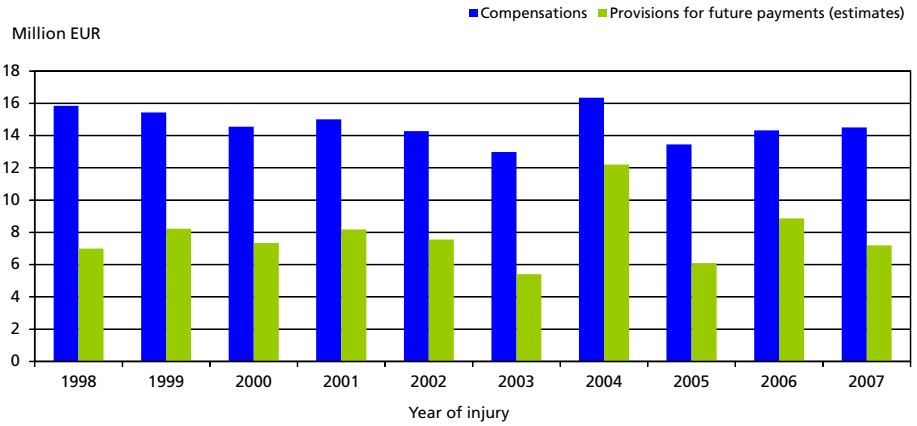

Figure 5. Compensation payments and provisions for future payments for injuries in public health care in Finland from 1998 to 2007 (million EUR, deflated for 2010, and as estimated in September 2011).

Insuring for patient injuries in the public health care sector is different from that in the private health sector (Palonen et al. 2005). Private health care providers take their insurance from one of the private insurance companies affiliated with the Patient Insurance Centre. Such an insurance company charges the private provider a premium that is based on the insurance company's own premium schedule and the estimated risks involved in the services of the provider. In contrast, in the public sector, the hospital districts bear the full liability for compensation payments for injuries occurred at their own institutions as well as at other organizations providing health or medical care within their geographical area, including primary care. The underwriter of the hospital districts' insurance is the Patient Insurance Centre.

As the hospital districts bear full liability for patient injuries while individual health professionals do not, the Finnish patient injury insurance scheme can be said to resemble an enterprise liability model (Abraham and Weiler 1994). In this model, a hospital or other health care provider organisation is held responsible for injuries instead of an individual health professional. This is believed to reduce costs of a patient injury compensation scheme and to promote patient safety, as a hospital is assumed to be in a better position than health authorities to implement qual-

ity and patient safety measures and to obtain health professionals' commitment to these. Furthermore, a hospital would be a large enough organization for risk-pooling. The idea of securing a large enough risk pool might have been an important aspect when hospitals districts were assigned full liability in Finland. However, exploiting hospital districts' full liability as an incentive for hospitals to implement responses following adverse events was perhaps not an explicit aim. In fact, choosing hospital districts as the units with liability has been explained by the rationale that it was simple, cheap, and would ensure all public sector providers would have an insurance coverage (Särkämö 2001).

Whether full liability for the hospital districts truly works as an incentive for promoting patient safety in Finland has not been studied. However, some pieces of information, discussed below, raise doubts about such an incentive's capability of affecting health care providers in Finland.

The yearly premium paid by hospital districts consists of compensation payments paid to patients during the year and administrative costs. Furthermore, hospital districts must allow for future compensation for injuries occurring up to the end of the year in their balance sheet. For instance in 2008, premiums paid by hospital districts totalled about EUR 30 million (deflated for 2010) and adjustment needed for future provisions some EUR 10 million (deflated for 2010) (Figure 6). While the amount of premium paid in cash is fairly stable from year to year, the size of the adjustment of provisions for future payments varies greatly. The variation in adjustments is even more pronounced at hospital district level (Figure 7). For instance, the premium paid by a middle-sized hospital district may vary from less than EUR 1 million up to EUR 2 million (corresponding to less or about 1% of its operation-

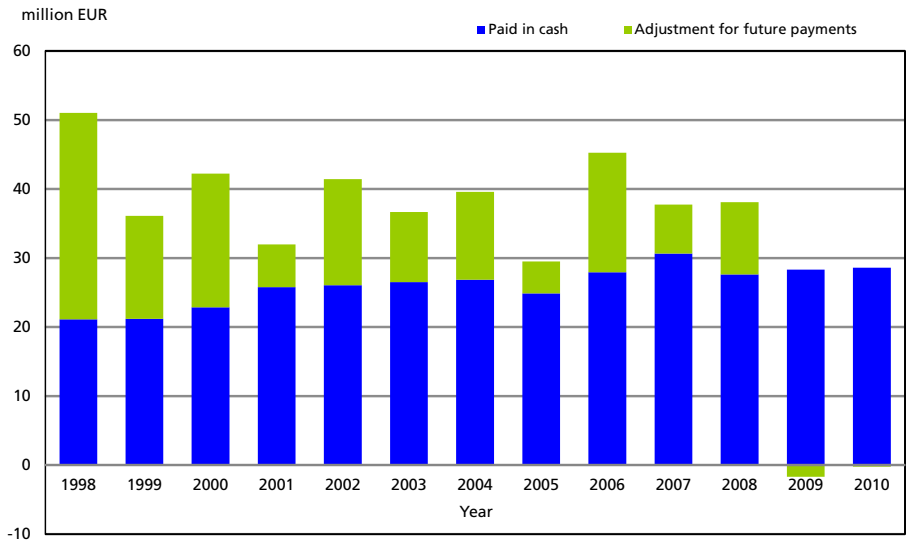

Figure 6. Patient injury insurance premiums paid in total by hospital districts in Finland from 1998 to 2010 (EUR, deflated for 2010; values for 2009 and 2010 forecasts).

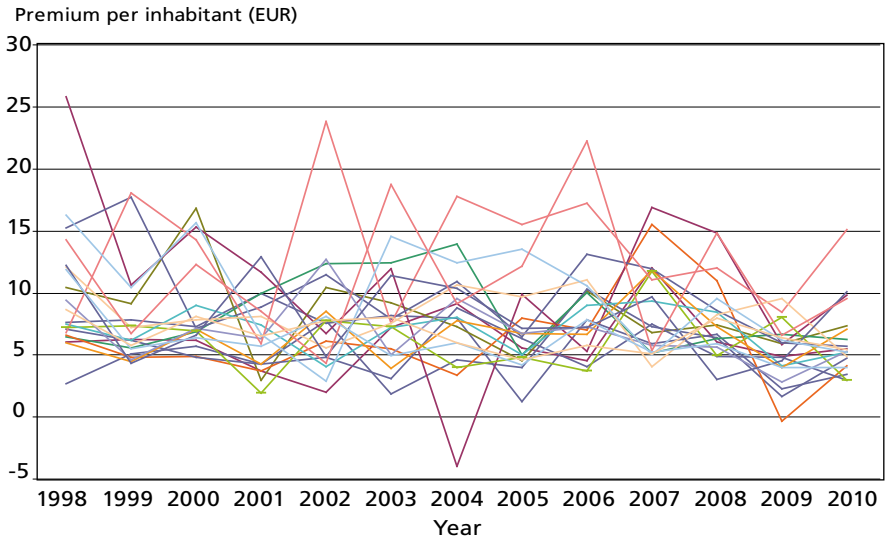

Figure 7. Patient injury insurance premiums paid by hospital districts from 1998 to 2010 (EUR, deflated for 2010; values for 2009 and 2010 forecasts; one line denotes one hospital district).

al costs). Such a variation obviously creates difficulties for the hospital districts in anticipating subsequent year's premiums and in taking these into account in their budget preparation.

The large yearly variation derives from the uncertainty regarding the amount of compensation payments in the future, as mentioned above. Particularly, estimation of future monetary compensations is difficult in the case of injuries that cause permanent disability, require constant medical care, and consequently are eligible for episodic payments over the patient's entire life span.

Apart from the yearly variation in premiums, hospital districts have complained about having to record the premiums, which they describe as "often being erroneous and exaggerated", into their bookkeeping as expenses (Accounting Board 2002). This means that if one year's premiums are higher than projected, hospital districts have to increase prices for their services or raise an additional payment from municipalities. If premiums are lower than projected, hospital districts have to register the surplus into their bookkeeping as accrued credits and deferred charges from municipalities (Accounting Board 2002).

Since a hospital district's one year premium may comprise compensation payments for injuries that occurred during the past year as well as costs of injuries that happened several years ago, hospital districts cannot connect this premium to specific injuries, which means that they cannot identify, for instance, the type, the speciality, or the date of the injury on the basis of the premium alone. In other words, the premium itself does not convey sufficient information for hospital districts to ena-

ble them to analyse the origins of patient injuries, learn from them, and take necessary precautions to prevent similar injuries in the future.

Hospital districts and the Patient Insurance Centre have recognized the above problems. As a consequence, the Centre has developed reporting and feedback systems with more detailed information (Mikkonen 2004, "Patient Insurance Centre" 2012), but these more detailed reporting systems are not public and their effect on provider performance and the occurrence of adverse events is unknown. Overall, it seems that they are poorly known among health care personnel.

The above features may be specific to Finland, but whatever reforms would be undertaken to correct any perceived problems with financing patient injury compensations, the Finnish scheme would still have to deal with the challenges that are typical of malpractice insurance in general. These include the long time-span from the occurrence of the injury until the filing of a claim and until the decision regarding compensation; difficult forecasting of future compensation payments because of the low incidence of claims; and the highly skewed distribution of the monetary amount of compensation payments between compensated claimants, which is due to the small number of severe injuries and the large number of relatively minor injuries (Danzon 2000, Sloan and Chepke 2008).

Even though hospital districts have to finance compensations for injuries occurring in primary care, they probably do not have much influence on the occurrence of injuries in this sector. Injuries in primary care, however, account perhaps for less than one third of all claims (Haikkala 2001) and are possibly less costly than injuries from care provided by hospital districts' specialized hospitals.

Due to the large variation in yearly premiums and the other problems described above, at the end of 2011, the Hospital District of Helsinki and Uusimaa - one of the 20 hospitals districts in Finland - decided to discontinue its insurance contract with the Patient Insurance Centre and to insure against patient injury compensation payments with one of the private companies that provide coverage for injuries in the private health care sector (Hospital District of Helsinki and Uusimaa 2011). It remains to be seen whether other hospital districts will follow such a decision.

2.5 Incentives for injury prevention alongside the Finnish patient injury insurance scheme

The patient injury insurance scheme in Finland has been set up solely to process patients' claims for monetary compensation. The claims handling process works independently alongside other regulatory and supervisory mechanisms. Consequently, a patient's claim does not initiate any legal or other disciplinary actions against health care organizations or health professionals.

However, a range of various other mechanisms exist alongside the patient injury insurance scheme that for health professionals and health care organizations at

least in theory should act as an incentive to undertake adequate actions to prevent adverse events. To what extent such incentive effects work in practice have not been studied in Finland.

In the final scenario, there is always the threat to a health professional of being sued. This happens rarely, as only about 20 health-care-related cases are brought to the courts yearly (Palonen et al. 2005). However, there is a somewhat larger probability of a health professional being investigated by one of the six Regional State Administrative Agencies or the National Supervisory Authority for Health and Welfare and to bear some consequences from this, such as being issued a notice or being told to give due care to one's professional conduct. In more serious cases, the National Supervisory Authority for Welfare and Health may issue a warning or limit or withdraw an individual's professional rights. Supervision by the National Supervisory Authority and the Regional State Administrative Authorities and its possible consequences do not only concern individual health professionals but also health care organizations. Organizations may, for instance, be restricted or forbidden to continue to provide services, if the National Supervisory Authority obliges them to do so. The Authority receives around 1000 complaints and notifications annually ("National Supervisory Authority for Welfare and Health" 2012).

Obviously, less formal incentives for adverse event prevention also operate in Finland. For instance, health professionals may be sensitive to occurrences that affect their reputation. Such an effect on reputation may emerge if patients complain to the management of her health care unit, which then has to sort out the complaint with the employee concerned. This is actually the action patients are encouraged to take first before resorting to any other formal complaints procedures ("Patient Insurance Centre" 2012). Furthermore, the publication of evidence-based guidelines and attitudes of professional associations probably have an important influence on health professionals' practices. The voluntary scheme "HaiPro" for reporting adverse events, which is increasingly being adopted at provider organizations, is anonymous and intended to act as a means to learn from errors and to prevent future adverse events (Ruuhilehto et al. 2011). In addition, various new patient safety initiatives have taken place at the national level, as described in Chapter 1.

3 Review of the literature on claims and compensations for patient injuries

3.1 Theoretical framework for filing a claim and receiving compensation

A patient files a claim if the expected benefits from filing a claim exceed the expected costs of filing (for instance, Shavell 1982, Sloan and Hsieh 1995). Consequently, in accordance with Sloan and Hsieh (1995), the expected value (E) of a claim can be stated as:

E= p*B - C, where

p is the probability of benefits, B the size of benefits, and C the expected costs of filing a claim. The probability and amount of B are based on a patient's own evaluation. B comprises most importantly the amount of monetary compensation. It may also include various non-monetary benefits such as obtaining explanations for the adverse event and obtaining a sense of an injustice being corrected.

The costs of filing a claim include costs incurred from the time and effort in filing a claim. Moreover, there may be emotional costs such as the psychological burden of having to process unpleasant events all over again and the fear of endangering good relationships with health care personnel.

Monetary costs of filing a claim in the Finnish scheme are presumably relatively small, because filing a claim is a fairly simple procedure involving, in principle, filling in a form with information on the health care provider organization (or in case of private care, the name of the physician or other health professional), the injury date, the patient's own description of the injury, and her reasons for the claim. The patient then delivers the form to the Patient Insurance Centre together with her signature or the signature of her trustee or that of a distributee of the deceased patient's estate. Later, if the patient's claim is successful, she presents receipts and other documents demonstrating the costs incurred from her injury.

Another reason for the generally low costs of a claim in Finland is that patients do not have to hire a lawyer. This happens nonetheless occasionally in situations in which patients seek a lawyer's assistance in requesting the Patient Injuries Board to re-evaluate their case or with regard to other legal issues (Siikavirta and Mikkonen 2012). Precise figures on the extent to which patients consult lawyers are not available.

Significant costs to patients in Finland, however, may be incurred from the effort and time spent on searching for the correct means to express dissatisfaction with care, for instance, from finding out whether to issue a complaint to the hospital management or the National Supervisory Authority for Welfare and Health, or to

file a claim with the Patient Insurance Centre, and how to do these (Figure 1); some of these costs may be incurred from discussions with a patient ombudsman.

Based on the above theoretical model, patients who experience more severe injuries and consequently incur larger losses, such as income losses and increased pain and suffering, are more likely to file a claim than patients with minor injuries; moreover, there is an increased probability of receiving compensation when the size of expected benefits are larger for the former patients (conditional on costs of filing being the same in both cases) (Danzon 2000). Likewise, elderly patients are less likely to file a claim, because their economic losses, in particular income loss, are likely to be smaller than those of working-age persons.

Other theoretical models have placed less emphasis on the monetary motivations behind a claim and more emphasis on other kinds of motivations. For instance, a model in sociology maintains that a person claims for damages if she feels that another person's actions caused the injury and that this other person is responsible or guilty for her injury and receiving compensation will be a remedy (Felsteiner et al. 1980).

Theoretical models for analysing the processing of claims and for how the outcome of claims is determined exist only for tort systems (Shavell 1982, Sloan and Hoerger 1991, Farber and White 1991). In such schemes, the processing of claims consists of various stages, including pre-trial discovery, negotiations, and occasionally a trial. This process is viewed as a means for the patient and the defendant to collect information; as more information accumulates regarding the defendant's liability, the plaintiff evaluates which of the different choices available to her—to drop or settle her case or proceed to trial—are worth pursuing. Such theoretical models for analysing the outcome of claims do not exist for no-fault schemes, presumably because the determination of the outcome of the patient's claim is much simpler than that in tort systems. For instance, in the Finnish case, the Patient Insurance Centre determines the compensability of a claim on the basis of the Patient Injury Act, which essentially involves determining whether the professional standard or any other of the seven criteria set out in the Act were met. Following this decision, the Centre determines the amount of compensation.

Obviously, the determination of the outcome of a patient's claim in a no-fault scheme may become more complex if the patient is dissatisfied with the decision of the Patient Insurance Centre. In such cases, patients have several alternatives to proceed, as discussed above (Figure 1).

3.2 Empirical studies on filing a claim and receiving compensation

3.2.1 Frequencies of adverse events, negligence, and claims

Table 2 summarizes the findings of studies where (more or less) independent experts analysed retrospectively the occurrence of claims following adverse events as well as the occurrence of adverse events and negligence in claims. Compared to the number of hospitalisations and even to the number of adverse events, claims are rare. For instance, in the sample collected in the Harvard Medical Practice Study comprising 30 121 hospitalized patients, only 46 filed a claim (Brennan et al. 1991a, Brennan et al. 1996), and in a sample of 2012 patients at a surgery department in Denmark only two filed a claim (Christoffersen and Holm-Nielsen 2004). Overall, the rate of claims varied from 0.1% to 0.2% of hospitalisations, while the rate of adverse events was from 3.8% to 13% of hospitalisations (Brennan et al. 1991a, Brennan et al. 1996, Thomas et al. 2000, Davis et al. 2003, Bismark et al. 2006b). The latter rate was 10% on average in a review that took into account all studies on the epidemiology of adverse events published up to that point (de Vries et al. 2008).

What is further apparent from Table 2 is that the distribution of adverse events and negligence in claims across studies differs greatly. The differing distributions may have been in part due to the very small absolute number of claims, at least in some of the studies. Nevertheless, a common feature seems to be that adverse events involving negligence comprise one portion of filed claims, adverse events without negligence another portion, and claims involving no adverse events the remainder. Moreover, in some cases where adverse events were present it had been impossible to judge whether these were caused by negligence or not.

Similar distributions emerged in regard to compensated claims. However, a notable feature here is that actual judgements regarding compensability and the studies' retrospective assessments of compensability—if compensability in the retrospective assessments is understood to comprise the presence of both an adverse event and negligence—overlap only in part. From 24% to 62% (81% in one study that assessed error instead of negligence) of claims that were actually compensated were identified by the retrospective studies to have involved both adverse events and negligence (Cheney et al. 1989, Brennan et al. 1991a, Farber and White 1991, Taragin et al. 1992, Brennan et al. 1996, Studdert et al. 2006). At the same time, from 9% to 44% of claims that by the same studies were recognized as having involved both adverse events and negligence received no compensation (again, the number of claims in some studies was very small).

To summarize the above, the vast majority of patients who suffer an adverse event due to flaws in their care, and thus in theory would deserve compensation, do not file a claim. Simultaneously, claims sometimes emerge even when patients' care was adequate and adverse events did not occur. With regard to compensation, a proportion of patients whose care was up to an expected standard either with or with-

Table 2. Overview of studies on the frequency of adverse events, negligence, and claims[a] (absolute numbers and percentages).

	Cheney et al. (1989)	Brennan et al. (1991a, 1996)	Farber and White (1991)	Taragin et al. (1992)	Thomas et al. (2000), Studdert et al. (2000)	Christoffersen and Holm-Nielsen (2004)	Davis et al. (2003), Bismark et al. (2006b)	Studdert et al. (2006)
Hospitalisations	-	30121	-	-	14700	2012	6579	-
AEs (% of hospitalisations)	-	1133 (3.8%)	-	-	587 (4%)	209	850 (13%)	-
AEs with negligence (% of AEs)	-	280 (25%)	-	-	161 (27%)	-	315 (37%) (high preventability)[b]	-
AEs without negligence (% of AEs)	-	850 (75%)	-	-	426 (73%)	-	216 (25%) (low preventability)[b] 319 (38%) (no preventability)[b]	-
Claims	1004	46	252	8231	18	2	14	1452[f]
AEs with negligence (% of claims)	469 (47%)	9 (20%)	80 (32%)	2000 (25%)	4 (22%)	-	6 (43%)[c]	889 (61%)[f]
AEs without negligence (% of claims)	400 (40%)	13 (28%)	95 (38%)	5132 (62%)	4 (22%)	-	5 (36%)[c]	515 (35%)[f]
No AE or negligence unclear (% of claims)	135 (13%) (Negligence unclear); 24 (2%) (No AE)	24 (52%) (No AE)	77 (31%) (Negligence unclear)	1099 (13%) (Negligence unclear)	10 (56%) (No AE)	-	3 (21%) (No AE)[c]	48 (3%) (No AE)[f]
Compensated claims (% of claims)	620 (62%)	21 (46%)	147 (58%)	3515 (43%)	-	-	10 (71%)	809 (56%)[f]
AEs with negligence (% of compensated claims)	385 (62%)[d]	5 (24%)	71 (48%)	1820 (51%)[e]	-	-	-	653 (81%)[f]
AEs without negligence (% of compensated claims)	168 (27%)[d]	6 (29%)	23 (16%)	1078 (30%)[e]	-	-	-	145 (18%)[f]
No AE or negligence unclear (% of compensated claims)	67 (11%) (Negligence unclear)[d]	10 (48%) (No AE)	53 (36%) (Negligence unclear)	648 (18%) (Negligence unclear)[e]	-	-	-	11 (1%) (No AE)[f]
Type of scheme	Tort	Tort	Tort	Tort	Tort	No-fault	No-fault	Tort

AE = Adverse event
a Studies on the frequency of adverse events that did not involve an investigation of patient injury claims were not included here.
b Davis et al. did not assess negligence but preventability, which they categorized into six classes ranging from no evidence to certain evidence of preventability.
c Bismark et al. did not assess negligence but classified AEs into compensable AEs, not compensable AEs, and no AE. In the above table, this classification corresponds to AEs with negligence, AEs without negligence, and no AE, respectively.
d Calculated from probabilities of receiving payment for negligent, non-negligent, and unclear negligent care as reported by the study.
e Calculated from probabilities of receiving payment for negligent, non-negligent, and unclear negligent care as reported by the study. The obtained figures do not sum up exactly to the total number of compensated claims, possibly owing to rounding and the study's omission of a few cases due to missing data.
f Instead of negligence, the study assessed error (however, the authors point out that there is not any clear difference between negligence and error). Furthermore, cases that were classified as dignitary injury and as cases where judgement about error was not made were counted here as claims involving no AEs.

out an adverse event receive compensation, while another proportion are denied compensation despite an adverse event entailing negligence. This latter discrepancy may not necessarily reflect poor or unequal decision-making of organizations regarding compensability but may also reflect the view expressed in many studies that assessing whether an adverse event resulted from negligence or not or whether it was preventable or not is often difficult (Brennan et al. 1991a, Johnson et al. 1992). Moreover, three of the studies in Table 2 explicitly stated that in 13% to 31% of filed claims and 11% to 36% of compensated claims, negligence was not definable (Cheney et al. 1989, Farber and White 1991, Taragin et al. 1992).

Mello and Hemenway (2004) applied to the above situation epidemiological terminology that described claimants having received substandard care as true positives, claimants having received the expected standard of care as false positives, non-claimants having received substandard care as false negatives, and non-claimants having received the expected standard of care as true negatives. Assuming filing a claim was a screening test, they subsequently calculated epidemiological markers, such as the sensitivity and specificity of the test, and concluded that filing of claims is comparable to a screening test for rare diseases with many false positives.

Despite the above discrepancies, a notable finding has been that the probability of filing a claim increases in accordance with the presence of adverse events and negligence. For instance, based on data from the Harvard Medical Practice Study, in cases where the patient's care did not entail an adverse event, the probability of filing was 0.001; if the patient experienced an adverse event but no negligence, the probability of filing was 0.01; and if the patient experienced an adverse event involving negligence, the probability of filing was 0.026 (White 1994).

The probability of obtaining compensation also increases with the presence of adverse events and negligence. If the patient experienced a negligent adverse event and filed a claim, the probability of receiving compensation was from 0.66 to 0.91 (Taragin et al. 1992, Farber and White 1994, Studdert et al. 2006). If the patient experienced a non-negligent adverse event and filed a claim, the probability of receiving compensation was from 0.16 to 0.21 (Taragin et al. 1992, Farber and White 1994, Studdert et al. 2006). The probability of receiving compensation was from 0.45 to 0.59 if negligence in regard to the adverse event was unclear (Taragin et al. 1992, Farber and White 1994).

The numbers of claims in Table 2 vary greatly between studies because the study methods were different. Those studies (for which the number of hospitalisations is displayed) investigated a sample of hospitalized patients' medical records and then linked these with filed claims data, whereas the other studies collected a sample of claims, for instance, from a medical malpractice insurer, without investigating adverse event rates in hospitalized patients. Further notable is that the frequencies of claims in hospitalisations as well as the presence of adverse events and negligence in claims did not markedly vary according to the type of compensation scheme, i.e., tort or no-fault, provided that negligence in no-fault schemes was understood to equal preventability or the local standard of compensability.

3.2.2 Factors associated with filing a claim and receiving compensation

The low claim rates compared to the rate of adverse events raises the question as to why only such a small fraction of patients with an adverse event file a claim. If the above theoretical model is considered, then one could infer that the adverse events of many patients are such that the expected benefits of filing do not exceed the costs. For instance, it may be that many patients have suffered a minor adverse event with short-term consequences only so that in these cases the costs of filing are not worth the expected compensation payment.

The assumption that the severity of adverse events plays a significant role in patient's decisions to proceed with a claim is confirmed by several empirical studies using interviews, medical records, or claims files (Table 3). These have found that the probability of filing a claim is significantly increased by the adverse event's severity irrespective of the type of data and compensation scheme in which the study was performed (May and Stengel 1990, Sloan and Hsieh 1995, Studdert et al. 2000, Bismark et al. 2006b, Dunbar and Sabry 2007). Severity is probably also partly reflected in variables such as days missed at school or work, which have also emerged as significant factors associated with filing a claim (Dunbar and Sabry 2007). Furthermore, a severe adverse event that has caused permanent disability has often been a stronger predictor of filing a claim than death (Sloan and Hsieh 1995, Bismark et al. 2006b), with the probable reason being that the expected compensation for death caused by an adverse event from health care is not as high (Bismark et al. 2006b).

In addition to severity, another important factor found to increase the probability of a claim is physician negligence, i.e. the situation in which care provided by a physician does not fulfil a commonly accepted standard (Sloan and Hsieh 1995). Related to negligence is the finding that patients are much more likely to file a claim if they feel that their adverse event is at someone else's responsibility or fault (Dunbar and Sabry 2007) (Table 3).

Regarding the effect of patient characteristics such as age, sex, and socioeconomic status on claims, age has emerged as perhaps the most influential (Table 3). The association between filed claims and age might actually follow a reversed U-shaped curve, as studies have indicated that children and adolescents (most likely refers to parent decision-making) as well as the elderly to be less likely to file a claim than middle-aged persons (Burstin et al. 1993, Studdert et al. 2000, Bismark et al. 2006b, Dunbar and Sabry 2007). Further support for such an association comes from a study in Sweden that compared claim rates across age groups: 0.32% of working-aged persons discharged from hospital filed a claim compared to an overall rate of 0.18% for all patients, while the equivalent rates for patients under 19 and over 80 were lower than the 0.18% overall rate (Pukk et al. 2003).

In contrast, patient's sex and socioeconomic status have produced less clear results. Male sex has in some studies had a negative association with filing a claim

Table 3. Empirical research into factors associated with filing a claim (Sign indicates the direction of the association of a factor with filing a claim: + increases, - decreases, 0 has no effect on the probability of filing a claim).

Study	Factor	Sign	Type of data	Scheme
May and Stengel (1990), Sloan and Hsieh (1995), Studdert et al. (2000), Bismark et al. (2006b), Dunbar and Sabry (2007)	Severity of adverse event/injury	+	Interview, medical records, malpractice insurance files, public agency	Tort, No-fault
Sloan and Hsieh (1995)	Death (or stillborn) (vs. major adverse event)	-	Interview, medical records	Tort
Bismark et al. (2006b)	Death (vs. temporary impairment)	0	Medical records, public agency	No-fault
Dunbar and Sabry (2007)	Days missed at work/ school	+	Interview	Tort
Sloan and Hsieh (1995)	Negligence of physician (external expert assessment)	+	Interview, medical records	Tort
Bismark et al. (2006b)	Compensation criteria met (external expert assessment)	+	Medical records, public agency	No-fault
Sloan and Hsieh (1995)	Causation (vs. no causation)	0	Interview, medical records	Tort
Dunbar and Sabry (2007)	Patient perceived someone else at fault of injury	+	Interview	Tort
Burstin et al. (1993), Studdert et al (2000), Bismark et al. (2006b), Dunbar and Sabry (2007)	Age	-	Medical records, public agency, malpractice insurance files, interview	Tort, No-fault
Bismark et al. (2006b)	1-17 years (vs. middle-aged)	-	Medical records, public agency	No-fault
Burstin et al. (1993), Studdert et al. (2000), Dunbar and Sabry (2007)	Male sex	0	Medical records, public agency, malpractice insurance files, interview	Tort
Bismark et al. (2006b)		-	Medical records, public agency	No-fault
May and Stengel (1990), Sloan and Hsieh (1995), Dunbar and Sabry (2007)	Education	0	Interview, medical records	Tort
Sloan and Hsieh (1995), Dunbar and Sabry (2007)	Income	0	Interview, medical records	Tort
Burstin et al. (1993), Studdert et al. (2000)[a]		+	Medical records, public agency, malpractice insurance files	Tort
Bismark et al. (2006b)	Deprivation (measured by residential area)	-	Medical records, public agency	No-fault
May and Stengel (1990)	Patient owns own home	0	Interview	Tort
Studdert et al. (2000)	Medicare or Medicaid (vs. private health insurance)	-	Medical records, malpractice insurance files	Tort
Sloan and Hsieh (1995)	Medicaid or other health insurance (vs. no health insurance)	0	Interview, medical records	Tort
Burstin et al. (1993)	Medicaid (vs. private health insurance)	0	Interview, medical records	Tort
Sloan and Hsieh (1995)	Private insurance (vs. no health insurance)	-	Interview, medical records	Tort
Sloan and Hsieh (1995)	HMO (vs. no health insurance)	-	Interview, medical records	Tort

a Reported a positive association between income and claim but the association was statistically insignificant.

Study	Factor	Sign	Type of data	Scheme
Burstin et al. (1993)	No health insurance (vs. private health insurance)	-	Medical records, public agency	Tort
Studdert et al. (2000)	No health insurance (vs. private health insurance)	0	Medical records, malpractice insurance files	Tort
Sloan and Hsieh (1995)	Length of hospital stay	+	Interview, medical records	Tort
Sloan and Hsieh (1995)	Days in neonatal intensive care unit	0	Interview, medical records	Tort
Sloan and Hsieh (1995)	Lived in community for long	+	Interview, medical records	Tort
Sloan and Hsieh (1995)	Patient negligence: Drinking during pregnancy Smoking during pregnancy Initiated prenatal care after 1st trimester Out-of-wedlock birth	 + 0 0 0	Interview, medical records	Tort
May and Stengel (1990), Hickson et al. (1992)	Support/advice from friends or other contacts	+	Interview	Tort
May and Stengel (1990) Dunbar and Sabry (2007)	Previous experience with litigation/filing a claim	+ 0	Interview Interview	Tort Tort
May and Stengel (1990)	Knowledge of health care or legal professional world	-	Interview	Tort
May and Stengel (1990)	Physician-patient-relationship: Doctor did not rush Doctor concerned about personal effects of care Doctor informed patient about care Doctor involved patient as "partner" Patient's evaluation of doctor's competence positive	 0 - 0 0 -	Interview	Tort
Sloan and Hsieh (1995)	Physician told about a problem Switched doctor (short-term relationship with physician)	- +	Interview, medical records	Tort
Hickson et al. (1992)	Patient-reported reasons: recognition of cover-up, need for money, recognition of long-term consequences, need for information, revenge or protection of others from harm	+	Interview	Tort
Sloan and Hsieh (1995)	Catholic (vs. protestant) Jewish, other religion, or no religion (vs. protestant)	+ 0	Interview, medical records	Tort
Sloan and Hsieh (1995) Bismark et al. (2006b) Burstin et al. (1993)	Non-white (vs. white) Hispanic (vs. non-Hispanic) Ethnic minority Black race	- 0 - 0	Interview, medical records, public agency Medical records, public agency Medical records, public agency	Tort Tort Tort

(Bismark et al. 2006b), though not in every study (Burstin et al. 1993, Studdert et al. 2000, Dunbar and Sabry 2007). Similarly, there is some indication that patient's low income and deprivation decrease the probability of a claim (Burstin et al. 1993, Studdert et al. 2000, Bismark et al. 2006b), but such an association has not always emerged (Sloan and Hsieh 1995, Dunbar and Sabry 2007). Furthermore, patient's education has not had a statistically significant relation with filing a claim (May and Stengel 1990, Sloan and Hsieh 1995, Dunbar and Sabry 2007).

Table 3 lists various other factors that studies have identified as having a statistically significant association with filing a claim. Among these, the most notable is the physician–patient relationship. If the patient has had a long-term relationship with her physician and perceives that the physician concentrates on her problems and communicates adequately, this reduces the probability of a claim. In effect, physician–patient communication has been suggested as an even more important factor with an influence on filing than the actual health care provided (Danzon 2000).

The association of patient's length of hospital stay with filing a claim has in one study been positive (Sloan and Hsieh 1995). This result, however, should perhaps be viewed with some caution, since studies that have modelled the association between length of stay and adverse events have identified patients' length of stay to be endogenous (Hauck and Zhao 2011). This indicates that an increase (decrease) in length of stay increases (decreases) the probability of an adverse event, but at the same time, the presence (absence) of an adverse event may be associated with an increase (decrease) in length of stay. Furthermore, the result regarding the availability of financial support from funding sources other than the patient injury compensation scheme such as the possession of health insurance cannot be used for making inferences regarding the importance of other funding sources in other countries, because the result may be country-specific.

Further reasons that have been discussed as possible explanations for not filing a claim are that patients may express their dissatisfaction by other means than demanding compensation, such as issuing a complaint to the hospital management or the health authorities. Moreover, patients may not always know they have encountered an adverse event (Bismark et al. 2006b). Whether health professionals in such situations should reveal the adverse event to the patient - or an error that did not cause any harm - is a difficult ethical issue, in particular in cases in which not unveiling the event would affect the patient's chances of obtaining compensation. This and other arguments favour the disclosure of such adverse events (Chamberlain et al. 2012).

As is apparent from Table 3, possibilities to investigate factors associated with filing a claim depend greatly on the type of data at hand. An interview, for instance, allows the exploration of factors such as patients' subjective views about their motives for their claim, which is not possible from register data. On the other hand, register data allow the use of larger samples than interviews.

Similar to filing a claim, both adverse event severity (Sloan and Hsieh 1990, Taragin et al. 1992, Farber and White 1994) and substandard care (Cheney et al. 1989, Sloan and Hsieh 1990, Taragin et al. 1992, Farber and White 1994, Studdert et al. 2006) increase the probability of obtaining compensation (Table 4). Substandard care has been assessed by independent experts and covered various notions of care below an acceptable standard such as negligence, medical error, and avoidability.

In contrast, a patient's non-pecuniary motives (such as the need for explanations for an adverse event) as well as the time from the adverse event to filing a claim (the latter possibly reflecting some ambiguity in the patient's injury) seem to have a negative association with receiving compensation (Table 4). The probability of receiving compensation is also affected by other diverse factors, such as type of defendant and malpractice insurer, but these are factors more specific of a tort than a no-fault scheme.

As is visible from Table 4, all of the studies mentioned have been conducted in a tort system. Similar studies regarding a no-fault scheme are extremely scarce, with information mainly restricted to one Swedish study. It compared the rate of compensated claims between men and women and found the rate of successful claims to be higher among women than men (Pukk et al. 2003).

Table 4. Empirical research into factors associated with receiving compensation[a] (Sign indicates the direction of the association of a factor with receiving compensation: + increases, - decreases, 0 has no effect on the probability of receiving compensation).

Study	Factor	Sign	Type of data	Scheme
Sloan and Hsieh (1990), Taragin et al. (1992), Farber and White (1994)	Severity of adverse event/ injury	+	Medical records, malpractice insurance files, malpractice claims reports to public authority, jury verdict reporters	Tort
Cheney et al. (1989)		0	Malpractice insurance files	Tort
Cheney et al. (1989), Sloan and Hsieh (1990), Taragin et al. (1992), Farber and White (1994), Studdert et al. (2006)	Substandard care (based on expert assessment and includes notions such as negligence, medical error, avoidability, and indefensibility of physician care)	+	Malpractice insurance files, malpractice claims reports to public authority, jury verdict reporters	Tort
Sloan and Hsieh (1990)	Statements about provider fault	+	Malpractice claims reports to public authority, jury verdict reporters	Tort
Sloan and Hoerger (1991)	Non-pecuniary motives for claim	-	Interview	Tort
Sloan and Hsieh (1990)	Time from injury to filing a claim	-	Malpractice claims reports to public authority, jury verdict reporters	Tort
Sloan and Hsieh (1990)	Others (e.g. type of insurer, type of defendant, and place of injury)	+, -, or 0	Malpractice claims reports to public authority, jury verdict reporters	Tort

a Compensation obtained either from settlement or court ruling.

Studies investigating determinants of the size of compensation payments have found that again adverse event severity (Cheney et al. 1989, Sloan and Hsieh 1990, Taragin et al. 1992, Farber and White 1994, Studdert et al. 2006) and substandard care (Cheney et al. 1989, Sloan and Hsieh 1990, Sloan and Hoerger 1991, Taragin et al. 1992, Farber and White 1994, Studdert et al. 2006) play a significant role and that the size of monetary compensation increases with the severity of the adverse event or the occurrence of error in patient care (Cheney et al. 1989, Sloan and Hsieh 1990, Taragin et al. 1992, Farber and White 1994, Studdert et al. 2006). However, one study that compared numbers of filed claims and compensated claims as well as amounts of compensation payments between medical specialities did not find any statistically significant association between numbers of filed (or compensated) claims and the amount of compensation paid. This lack of association indicated, according to the authors, that factors affecting the filing of a claim might differ from those affecting the size of compensation payment (Jena et al. 2011).

The distribution of monetary compensations is highly skewed to the right so that the majority of compensated claimants obtain fairly small or moderate payments, whereas a minority of compensated claimants receive relatively large payments (Farber and White 1991, Taragin et al. 1992). Nevertheless, the size of compensation in the case of severe injuries has been shown to be often much less than the economic loss from the injury (Sloan and Hoerger 1991).

3.3 Other aspects to claims

3.3.1 Distribution of claims between health care providers

The large variation in adverse event rates between hospitals and medical specialities (Brennan et al. 1991b, Leape et al. 1991, Hauck et al. 2012) has also appeared with patient injury claims (Hickson et al. 2002, Pukk-Härenstam et al. 2008, Jena et al. 2011). Similarly to adverse events, the majority of filed claims have concerned care provided by surgical specialities (Pukk-Härenstam et al. 2008, Bishop et al. 2011, Jena et al. 2011) with the highest claim rates found in neurosurgery, thoracic-cardiovascular surgery, general surgery and orthopaedics, and lowest in family medicine, paediatrics, and psychiatry (Jena et al. 2011). Whether claim rates at hospital- or speciality level are associated with the quality provided by hospitals or specialities has not been subject to much research. One study that examined the association between the quality of nursing home care and claims found that nursing homes of poorer quality had a slightly increased risk of having a claim filed against it (Studdert et al. 2011).

A study that reviewed 10 739 claims in the year 2009 found that 47.6% of compensated claims concerned injuries in inpatient care, 43.1% outpatient care, and 9.4% both inpatient and outpatient care (Bishop et al. 2011). Despite the rather sim-

ilar share for inpatient and outpatient care, average payments for injuries in inpatient care were higher than those in outpatient care.

When individual physicians are viewed, then claims are not equally spread across physicians. Even within a speciality more claims are filed with regard to the care of some physicians than the care of others (Sloan et al. 1989, Weycker and Jensen 2000, Hickson et al. 2002). Whether the care provided by those physicians with a larger number of claims is of poorer quality or otherwise different from that provided by those with fewer claims is not entirely clear. Some studies have shown that the past number of claims or the size of compensation payments is not related to the number of claims or the quality of physician care in the future (Entman et al. 1994, Taragin et al. 1995). In contrast, some other studies have shown that physicians with more claims or higher paid claims in their past will also have more or higher paid claims in the future (Weycker and Jensen 2000). Despite these contradictory results, several studies have shown that patients are more dissatisfied with and complain more often about physicians who have a larger number of filed claims or higher paid claims (Sloan et al. 1989, Hickson et al. 1994, Hickson et al. 2002, Stelfox et al. 2005).

Danzon (Danzon 2000) suggested two possible explanations for the above: either it may be that following claims, physicians improve the clinical care they provide but do not change their behaviour otherwise, for instance, their way of communicating with patients, or it may be that physician's behaviour such as their communication with patients and other aspects of the physician-patient-relationship has a larger effect on filing a claim than the quality of physician's actual medical care.

3.3.2 Causes, nature, and consequences of adverse events identified in claims

Whether and to what extent the causes, nature, and consequences of adverse events that generate claims deviate from adverse events that do not generate claims is known only to a limited extent. As discussed above, certain factors such as age and adverse event severity affect the tendency to file a claim, which could imply that adverse events involving claims are more severe, concern a larger share of middle-aged persons, and otherwise have specific characteristics that distort this fraction of adverse events compared to adverse events not involving claims. Nevertheless, the causes of adverse events involving claims are probably not essentially different from adverse events not involving any claims (Regenbogen et al. 2007).

The pathway that has been described as leading to an adverse event is a sequence of deficiencies in the structures and processes that should protect from adverse events. These deficiencies as such may not necessarily lead to an adverse event, but together or by following one after the other under particular circumstances do ("the Swiss cheese model") (Reason 2000). It has been argued that the deficiencies are flaws in the organization and management of health care organizations rather than

flaws in the performance of an individual health professional (for instance, Runciman et al. 1993, Ternov and Akselsson 2005). However, it has been criticized that the meaning of the term "organization" is unclear or has different connotations across studies and that scientific evidence is not sufficient to support the view that either individual factors or organizational factors would be important contributors to adverse events (Hoff et al. 2004).

Examples of factors that various studies have found contribute to the occurrence of adverse events are deficiencies in communication, inadequate documentation in medical records, insufficient training, insufficient supervision of junior staff, long working hours, improper practices at patient's transfer or discharge, non-standardization, and timetabling problems (the list is not exhaustive) (Neale et al. 2001, Morris et al. 2003, Landrigan et al. 2004, Neily et al. 2009, van Wagtendonk et al. 2010). When such contributors were classified into human, organizational, and patient-related factors, human factors were found to contribute to adverse events in 61% to 72%, organizational factors in 14% to 16% (Smits et al. 2010, van Wagtendonk et al. 2010), and patient-related factors in 39% of adverse events (Smits et al. 2010).

Similar contributory factors and failures in treatment processes have appeared for adverse events identified in patient injury claims. A study that investigated a sample of claims involving errors in surgical care specifically found health professionals' judgement errors and failure of vigilance or memory to be influential factors in 66% and 63% of the examined cases, respectively (Rogers et al. 2006). Lack of technical competence and communication breakdown contributed to adverse events in 41% and 24% of cases, respectively, while in about a quarter, patient-related factors such as complex medical history or unusual anatomy added to the occurrence of the event. The remaining causes were other system factors such as lack of supervision and failure in technology, the latter two of which had an impact in 18% and 15% of adverse events, respectively. As can be inferred from the percentages mentioned, several factors jointly played a part in the occurrence of any single adverse event: the median number of influential factors per adverse event was three and in 62% of cases more than one physician had some effect on the occurrence of the event.

In the same study (Rogers et al. 2006), 75% of the errors arose during surgery, 25% prior to surgery, the remainder after surgery, while in about a third of claims, errors happened at several stages of the patient's treatment process. Furthermore, more than half of the errors that arose during surgery originated from an error in manual technique.

Inexperience and insufficient skills of health professionals have often been suspected as one cause for adverse events and claims. For instance, medical students and physicians in their specialist training have been involved particularly in injuries that have resulted from flaws in teamwork such as failures in communication and lack of supervision (Rogers et al. 2006, Singh et al. 2007). Nevertheless, one study on claims involving technical errors in surgical care discovered that the majority of errors actually originated from everyday surgical procedures conducted by experi-

enced physicians, who, however, had to perform these on more complicated patients or in the presence of organizational deficiencies (Regenbogen et al. 2007).

The consequences of adverse events identified in claims have varied widely, comprising a vast range of complications such as organ injuries, cardiovascular and respiratory problems, infections, and neurologic damage (Griffen et al. 2007). In regard with errors from surgical care, 13% of the errors resulted in minor injury, 65% in more severe injury, and 23% in death. A comparable distribution appeared from a more detailed analysis of technical errors in surgery (Regenbogen et al. 2007).

In regard to primary and emergency care, the most common error in claims concerning the care in these sectors of health care has been missed or wrong diagnosis (Phillips et al. 2004, Kachalia et al. 2007, Brown et al. 2010, Bishop et al. 2011). It has often derived, similarly to above, either in part or entirely by failures in judgement and vigilance or memory and been caused by several contributory factors and failures in treatments processes jointly (Gandhi et al. 2006, Kachalia et al. 2007). The consequences have varied from minor to severe injuries and death (Gandhi et al. 2006).

Adverse drug events have been identified in 6% of claims, of which almost half have been serious (Rothschild et al. 2002). The medications that contributed most often to adverse events in claims were antibiotics, medication for mental illnesses, and cardiovascular medications.

As stated above, patient-related factors also play a part in the emergence of adverse events. Yet, one study suggested that the increased number and complexity of medical procedures performed on more risky patients increases the probability of an adverse event rather than these patients' individual risk factors as such (Aranaz-Andrés et al. 2011).

Studies that have analyzed the characteristics of adverse events resulting in claims specifically following CABG are scarce. One study from Denmark examined claims involving a mediastinitis (Petersen et al. 2008). This severe complication from CABG led to a claim to the Danish Patient Insurance Association (the equivalent to the Finnish Patient Insurance Centre) only in the minority of all mediastinitis cases in the country. Nevertheless, mortality rate in the studied claims was 7% and the median inpatient length of stay was 73 days, suggesting a marked increased in resource utilization.

In a study on THA and TKA, adverse events that most often generated a claim were nerve injury, limb length discrepancy, infection, vascular injury, and hip dislocation (Upadhyay et al. 2007). In a survey of surgeons, the surgeon-specific volume of THA and TKA operations and practice size did not affect the probability of a claim (McGrory et al. 2009). In another study on arthroplasty, deficiencies in obtaining informed consent from patients and deviations from generally accepted treatment guidelines were frequent reasons for patients receiving compensation (Bhutta et al. 2011).

3.3.3 Differences in motives for complaints and claims for compensation

In addition to filing a claim for compensation, patients have other options to express their dissatisfaction with health care and to obtain, if not money, then non-pecuniary compensation, such as psychological benefits from obtaining explanations or from the perception that justice has been done.

A study in New Zealand investigated differences in the characteristics of patients who filed a claim for monetary compensation with the Accident Compensation Corporation and patients who complained to the Health and Disability Commissioner (Bismark et al. 2006a). The latter organization corresponds by and large to the National Supervisory Authority for Welfare and Health and the former to the Patient Insurance Centre in Finland.

The New Zealand study found that those who decided to file a claim with the Accident Compensation Corporation were more likely to be working-aged and therefore more likely to have endured higher economic losses. Moreover, a severe injury that caused permanent disability also increased patient's propensity to request monetary compensation. In contrast, the main motives of complaints to the Health and Disability Commissioner were the desire for organizational change or other measures to avoid similar damages from occurring in the future and better interaction with health professionals, such as them providing explanations, admission of guilt or apology. Furthermore, adverse events that had caused a patient's death were more likely to result in a complaint to the Health and Disability Commissioner than a claim to the Accident Compensation Corporation.

Similar to the above, in another study a temporary injury was a frequent motivation in complaints issued to the hospital administration, while permanent damage triggered claims for compensation (Farber and White 1994). Another study from New Zealand (Bismark et al. 2006c) that examined complaints specifically to the Health and Disability Commissioner found the severity of injury and death to be positively associated with complaints, while the elderly, minority groups, and persons living in disadvantaged areas were less likely to complain.

Thus, in general terms, claims for compensation seem to derive from severe adverse events with significant economic losses, whereas complaints concern mainly the competency and the behaviour, such as the communication of health professionals and entail requests for actions to correct these (Daniel et al. 1999, Temelkovski and Callaghan 2010, Bismark et al. 2011).

3.4 Costs of adverse events with and without claims

Studies on the costs associated with patient injury insurance have investigated factors affecting the amount of compensation payment (for instance, Studdert et al. 2006), the distribution of monetary compensations between compensated claim-

ants (for instance, Taragin et al. 1992, Farber and White 1994), the costs of the compensation scheme (for instance, Mello et al. 2010), and the association between compensation payments and health care expenditure (for instance, Roberts and Hoch 2009). Nevertheless, to our knowledge, studies that would have examined specifically the health care costs of patient injury claimants following their injury do not exist. Since such information is not available, the outline below of studies on the costs of adverse events may give a rough idea of the health care and other costs of patient injury claimants.

The majority of studies on the costs of adverse events have examined the costs of such events emerging from inpatient care. In such studies, the average number of additional bed days due to an adverse event, as available from studies on the epidemiology of adverse events, has been multiplied by a bed day price (sometimes the costs of additional medical procedures have been added to the obtained estimate). This was done, for instance, in the Netherlands, where an adverse event was found to prolong the average length of a hospital stay by 9 days and to impose hospitals additional costs of EUR 355 million (in 2004), a sum that represented about 1% of the country's total health expenditure (Hoonhout et al. 2009). In New Zealand in 1998, the increase in length of stay was also about 9 days which resulted in extra costs to the health care system of NZD 870 million (Brown et al. 2002). Similarly high costs have been estimated in other countries (Runciman and Moller 2001).

More recent studies have been conducted by using information obtainable from hospital computer systems. For instance, in a study in the United States, postoperative respiratory failure, postoperative wound dehiscence, and infection due to medical care created an extra cost of USD 36 673 (extra cost 301% of cost), USD 31 614 (extra cost 222% of cost), and USD 42 309 (extra cost 256% of cost) (in the fiscal year 2007), respectively (Carey and Stefos 2011b). The marginal cost of an adverse event amounted to USD 22 413 (in 2007) (Carey and Stefos 2011a).

A study from Australia that also used information from hospital computer systems found that an adverse event increased the cost of a hospitalisation by almost AUD 7000 (between mid-2003 and mid-2004). This meant that adverse events cost the hospitals included in the study about AUD 460 million, in other words about 16% of their total expenditure (Ehsani et al. 2006).

The types of treatments or actions that have been found to be the largest contributors to adverse event costs are 1) surgery 2) pharmaceutical care, and 3) missed or delayed diagnoses or treatment procedures (Thomas et al. 1999, Zhan and Miller 2003). By using a different categorization, a study on Australian public hospitals ranked adverse events according to their impact on hospital costs: septicaemia (AUD 41 million), complications of cardiac and vascular implants excluding septicaemia (AUD 29 million), lower respiratory infections (AUD 28 million), and urinary tract infections (AUD 25 million) (between 2005 and 2007) (Jackson 2011).

Studies available on the costs of adverse events in outpatient care have largely focused on adverse events from pharmaceutical care. One example of such a study is

from the Unites States, where adverse events from pharmaceutical use were estimated to cost altogether about USD 8 billion per year (in 2007) (Burton et al. 2007). Another study that examined admissions that were induced by outpatient pharmaceutical use discovered that such an admission cost EUR 5461 and, rising to EUR 6009 if production losses were included (Leendertse et al. 2011).

There is evidence that adverse events from inpatient care have consequences beyond patient hospitalisation. According to one estimate, 20% to 30% of the costs of adverse events occur after hospitalisation (Encinosa and Hellinger 2008). Furthermore, in the United States, the costs for Medicare patients with an adverse event compared to patients without such an event were 28% higher in the 27 months that followed (Carter and Porell 2011). If the lifetime costs of patients were viewed, then about 3% of patients who endured an adverse event had notable costs following the event over their entire life span, amounting in 1989 to more than USD 100 000 per patient (Johnson et al. 1992).

The two studies that examined costs inflicted by adverse events not only on the health care system but also on the remainder of society were conducted already some time ago, but nevertheless, provide convincing evidence of the magnitude of such costs. The first of them, conducted on adverse events suffered by hospitalized adults in the state of New York during the year 1984, discovered that adverse events cost USD 189 per capita, totalling USD 3.4 billion; later data from Utah and Colorado in 1992 showed the corresponding figure was USD 132 per capita, totalling USD 662 million (expressed in USD in 1996) (Johnson et al. 1992, Thomas et al. 1999). Of these, the costs of health services needed for the treatment of adverse events made up roughly one half and the costs generated by lost income and lost household production together the other half. This meant that adverse events not only generated costs to the health care system but also had a huge influence on other sectors of society. Overall, the Utah and Colorado -study estimated total costs of adverse events in the United Stated to correspond to about 4% of the country's total health expenditure (Thomas et al. 1999). The cost estimates obtained in the New York study were mainly based on interviews of patients with an adverse event, whereas those of the Utah and Colorado study were based on assessments made by medical and malpractice insurance experts.

Health care costs of patients who have filed a claim following CABG, THA, or TKA have not been studied previously. However, some studies have focused on these procedures' adverse event costs. For instance, following CABG, renal failure increased patient's health care costs by USD 49 128, mediastinitis by USD 62 773, and death by USD 49 242 (study data from 2004 to 2007) (Speir et al. 2009). High costs of certain adverse events from THA and TKA have emerged particularly from revision operations. For instance, a revision operation of the hip was in one study USD 7171 (in 2003 USD) more expensive than a primary THA. However, if a revision was undertaken due to a deep infection, it was four times more expensive (Bozic and Ries 2005, Bozic et al. 2005, Klouche et al. 2010). With regard to TKA, average hos-

pital fees for a revision owing to a deep infection have been calculated to be almost double that of a revision owing to another cause (in 2005) (Lavernia et al. 2006). In an Australian study, complication of an orthopaedic implant created an extra cost of AUD 11 994 per hospitalisation, which made it the fifth most expensive individual complication (Jackson et al. 2011).

4 The aim of the research

The aim of this research project was to produce descriptive and analytical information on claims and compensations for patient injuries, to evaluate the use of claims in performance measurement, and to estimate costs of patient injuries. The study objectives were in more detail:

1) To produce a descriptive analysis of both filed and compensated patient injury claims (J.J. et al. unpublished results),
2) To identify patient- and hospital-level factors associated with claims and compensations for patient injuries (Studies I and II),
3) To establish whether both filed and compensated claims for patient injuries are associated with the quality of care and whether an indicator measuring hospital claim rates would be applicable for performance measurement (Study III),
4) To calculate the differential in health care costs between compensated claimants, claimants denied compensation, and non-claimants (Study IV).

5 Data and methods

5.1 Linking of data

Data were retrieved from the Hospital Discharge Register and the Hospital Benchmarking database (Linna and Häkkinen 2008). The latter data source contained, at the time of the data collection, information on patients' inpatient admissions and outpatient visits to two foundation hospitals as well as to public hospitals maintained by hospital districts (i.e., health centres providing specialized health care were not included), while the former data source contained patient-level data on all public and private inpatient admissions in Finland. However, since a substantial part of both registers overlap, the Hospital Discharge Register is here understood to comprise the Hospital Benchmarking database, unless otherwise indicated.

The Patient Insurance Centre compiled from its register a patient-level dataset comprising information on claims concerning injuries that occurred between 1998 and 2003. The study period in Study I extended only until 2002, because at the time of conducting Study I, the Centre's data for 2003 were incomplete. Based on the experience gained from this research project, it became apparent that one year's claims data takes four years to accumulate fully or almost fully, due to the fact that patients are allowed to file their claim within three years, and in exceptional cases ten years, as well as the additional time needed by the Centre to process the claims. Claims processing took on average 8 months during the study period, as calculated from the data available for this research.

The Patient Insurance Centre data were restricted to public sector providers, since a substantial number of injuries in the private sector originate from dental care. Furthermore, the initial aim of this research was to link claims to those inpatient admissions and outpatient visits on which data were available from the Benchmarking database.

Information found in the Patient Insurance Centre's register that in principle is equivalent to information from the Hospital Discharge Register and enables the linking of these two data sources with each other includes the patient's personal identity number (following its encryption), the provider organization's code, as well as the patient's diagnosis and surgical procedure codes. Furthermore, the injury date specified for each claim should be located between a discharge and admission date or should coincide with the date of an outpatient visit.

Linking the entire Patient Insurance Centre data with the Hospital Discharge Register, which was the initial objective, turned out to be extremely difficult. Only about 60% of claims could be linked with a visit or an admission from the Hospital Discharge Register, and even then, many of the linked claims were simultaneously linked with several admissions or visits. At the same time, about 40% of claims could not be linked with any admission or visit.

The main reason for the datasets being linked inadequately was that equivalent information in the two registers was not present to a sufficient extent. For instance, the Patient Insurance Centre's register contained information on the type and place of injury based on the Centre's own classification (e.g. surgery, anaesthesia, and delivery) but not any information on either the medical specialty in which the injury occurred or the type of service, i.e., whether the injury occurred in outpatient, out-of-hours, or inpatient care; the latter kind of information would have been available from the Hospital Discharge Register. Consequently, one typical situation in which a claim was linked with multiple rows from the Discharge Register was one in which the patient apparently had first sought care at the emergency department of a hospital (registered as an out-of-hours visit) and then was admitted to an inpatient department (registered as an admission), but there was no information in the data of the two registers as to where the injury took place.

To allow linkages of data at least in part, the following measures were adopted:

(1) One dataset was constructed in which data were restricted to the year 2000 and public hospitals that were included in the Hospital Benchmarking database
(2) Datasets were constructed in which data were restricted to three surgical procedures: coronary artery bypass grafting (CABG), total primary hip arthroplasty (THA), and total primary knee arthroplasty (TKA)

Measure (1) reduced the number of observations markedly, which allowed the use of diverse rules for linking (Appendix 1) as well as the examination of claims and admissions (including visits) individually. Such an assessment done row by row to check whether any piece of information in the data supported linking or not would have been extremely laborious with the entire six-year data.

Measure (1) thus produced a dataset that comprised specialized health care provided in 2000 by hospital districts' hospitals. These hospitals provide the bulk of specialized health care in Finland so that specialised health care that was provided by the private sector and health centres were excluded. The reason for having selected the year 2000 was that at the time of constructing the dataset, claims data were available only from 1998 to 2001. The year 2001 was not chosen because of a doctors' strike during that year.

In consequence, measure (1) allowed the linking of 99% of claims. However, the linking of many of these claims entailed considerable subjective judgments and much uncertainty remains as to whether all of the 99% of claims were really linked correctly. Therefore, when data for the year 2002 were available, a further linking was done with data on the same hospitals but for the year 2002. This linking applied the simple rule where the personal identity number and the hospital-, diagnosis- and procedure codes had to be identical in both registers, while the injury date had to be between the admission and discharge date or the injury date had to be equal to an

outpatient visit date. Following this rule, a claim was linked to an admission or an outpatient visit in 72% of cases. The higher percentage of 72% as compared to the initial 60% mentioned above was possible to achieve, because the number of hospitals was smaller and outpatient care at health centres - on which Hospital Benchmarking data were not available - were excluded.

The linkages regarding both the years 2000 and 2002 allowed for descriptive analyses of claims for research question 1) (Tables 8–10).

The reason for applying measure (2) was that the three surgical procedures chosen take place in inpatient care and the surgery departments of hospitals so that the linking process did not have to consider claims related to outpatient visits and admissions to hospital departments other than the surgery department. This considerably facilitated the linking of claims (the linking process of CABG data is visible from the Appendix of Study I, while the process for THA and TKA is visible from Appendix 2).

The reason for selecting CABG, THA, and TKA was that they rank high when viewing the frequency of claims following individual surgical procedures. Likewise, THA and TKA have actually had from year to year the highest number of both filed and compensated claims ("Patient Insurance Centre" 2012). Moreover, selecting specific surgical procedures allowed for an examination of individual risk factors that may influence the occurrence of claims specifically following these procedures, thus providing more detailed information for adverse event prevention.

In addition to the patient-level data mentioned above, the Patient Insurance Centre provided hospital-district level data that were further modified here to produce Figures 2–7.

5.2 Construction of the CABG, THA, and TKA datasets

This Section describes the construction of the datasets for CABG (Study I and IV), THA (Studies II-IV), and TKA (Studies II-IV) together with the inclusion and exclusion criteria, while Sections 5.3–5.5 describe the variables and methods used in each Study in more detail.

The procedure codes that defined the sample of CABG patients were codes indicating coronary artery bypass grafting (FNA-FNE according to the Nordic Medico-Statistical Committee's classification). However, patients who had had a concurrent valve repair were excluded (procedure codes FG*, FJE*, FJF*, FJW*, FK*, and FM* as well as codes 21*, 22*, 23*, 24*, 25*, of which the latter five codes indicated a valve operation according to the classification of heart procedures adopted by the Hospital Discharge Register) (Table 5).

Table 5. Overview of data and methods used throughout the research.

Study	Service/ surgical procedure	Years	Inclusion criteriaa	Exclusion criteria[a]	Number of observations	Level of data	Method
J.J. et al. unpublished results	Specialised health care	2000 and 2002	Public hospitals	Health centres and private sector	Year 2000: n=4184 Year 2002: n=3006	National level	Summary statistics
I	CABG	1998-2002	Procedure indicating CABG: FNA-FNE	- Procedure and Hospital Discharge Register's codes indicating valve operation: FG, FJE, FJF, FJW, FK, FM, and 21-25	Stage 1: n=17 834 Stage 2: n=427	Patient-level (productivity at hospital-level	Two-stage logistic regression analysis
II	THA and TKA	1998-2003	THA: diagnosis M16.0 or M16.1; procedure NFB30–NFB60 or NFB99 TKA: diagnosis M17.0 or M17.1; procedure NGB10–NGB99	- A subsequent contralateral arthroplasty between 1998 and 2003 - Secondary osteoarthritis - Concurrent arthroplasty of the hip and knee - Åland Islands - Data on prosthesis type missing	Stage 1: THA: n=16 646 TKA: n=17 535 Stage 2: THA: n=408 TKA: n=437	Patient-level (volume at hospital-level)	Stage 1: logistic regression analysis Stage 2: multinomial logistic regression analysis
III	THA and TKA	1998-2003	Same as above	Same as above	Data with 1-year values: n=198 Data with 6-year values: n=35 THA: n=16 646 TKA: n=17 535	Hospital-level Patient- and hospital-level	Pearson correlation index Logistic regression analysis
IV	CABG, THA, and TKA	1998-2003	Same as in I-III	CABG: - Procedure codes and Hospital Discharge Register's codes for valve operation: FG, FJE, FJF, FJW, FK, FM, and 21-25 - Length of stay 28 days or longer - Åland Islands THA and TKA: - The same as in II and III except for prosthesis type	CABG: n=20 500 THA: n=17 506 TKA: n=18 512	Patient- and hospital-level	Generalised linear model with gamma distribution and log-link function

a Diagnosis codes based on the Finnish version of the 10th revision of the International Classification of Diseases and procedure codes on the Nordic Medico-Statistical Committee's classification.

As is apparent from Tables 5 and 6, the number of observations in the CABG dataset in Study I differs from that in Study IV. The latter comprised a different study period and applied the exclusion criteria adopted on CABG in the PERFECT (Performance, effectiveness, and costs of treatment episodes) project (Seppälä et al. 2008). These criteria led to the exclusion of patients whose length of stay was 28 days or more or whose place of residence was the Ålands Islands (the latter is common practice in these kinds of studies because of the autonomous status of the Åland Islands and because of the number of patients obtaining health services in Sweden being largely unknown).

The criteria applied in compiling the THA and TKA dataset were for the most part the same as those developed by the study on costs and outcomes of arthroplasty surgery in Finland (Mäkelä et al. 2011). Consequently, the THA and TKA data comprised patients having had a primary total arthroplasty owing to primary osteoarthritis (Table 5). The diagnosis codes used as inclusion criteria were M16.0 or M16.1 for the hip and M17.0 or M17.1 for the knee (following the Finnish version of the International Classification of Diseases, tenth revision) and the procedure codes were NFB30–NFB60 or NFB99 for the hip and NGB10–NGB99 for the knee. This initial dataset was further modified by applying a number of exclusion criteria as defined by Mäkelä et al. (2011) (Figure 8). The first of the exclusion criteria ruled out admissions of patients involving a second (contralateral) primary THA (or TKA) between 1998 and 2003 following their first THA (or TKA). This exclusion was done to make certain that observations were independent. The second exclusion criterion entailed the omission of patients whose records in the Hospital Discharge Register back to 1987 (the first year covered by the register) and the Social Insurance Institution's registers on reimbursement for medications in the special reimbursement category indicated that they had secondary osteoarthritis (Appendix 3). The final criterion, information on prosthesis type missing, was allowed, because the distribution of these patients without information on prosthesis type across hospitals and years as well as their individual characteristics varied arbitrarily (criterion not applied to Study IV where information on the type of prosthesis was not required).

The main difference between the dataset compiled in this research and the one by Mäkelä et al. (2011) were the refinements made by this research to the criteria for excluding patients with secondary osteoarthritis (Appendix 3; applied to Studies II-IV) and the definitions of disease groups used for risk adjusting the quality and claims indicators (Appendix 4; applied to Study III). These were slight changes, foremost because the diagnoses indicated by Appendix 3 are rare.

The resultant dataset was subsequently linked with the Patient Insurance Centre data (Appendix in Study I and Appendix 2), which allowed the introduction of variables indicating whether the patient had filed a claim or not, whether she had obtained compensation or not, and for what kind of injury (treatment injury, infection injury, or other kind of injury) she had obtained compensation for. The total numbers of patients identified as having filed a claim and received compensation

are given in Table 6. Claims that were mild injuries according to the Patient Insurance Centre's classification but received no compensation, implying the compensation payment would have been less than EUR 200, were regarded throughout Studies I–IV as claims denied compensation.

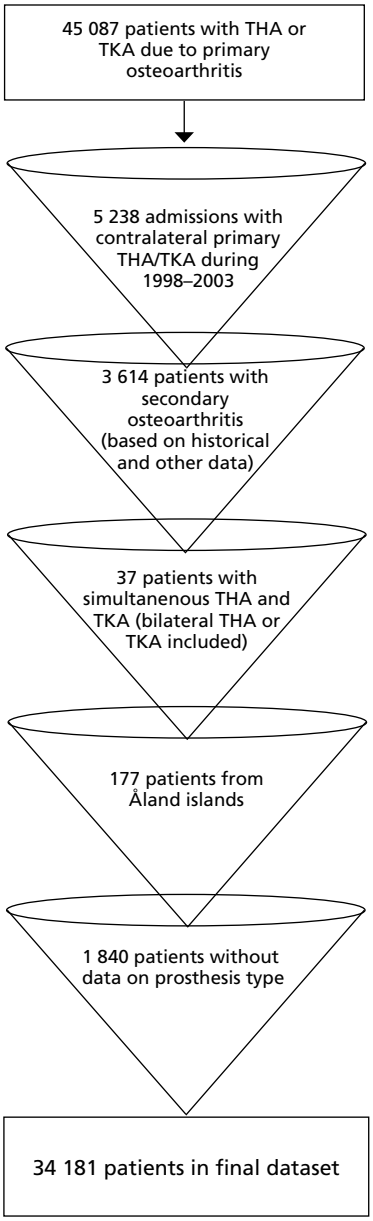

Figure 8. Exclusion criteria applied in the construction of the THA and TKA datasets.

Table 6. Number of CABG, THA, and TKA patients who filed a claim and received compensation as identified on the basis of linkages of the Hospital Discharge Register with Patient Insurance Centre data (years 1998 to 2003 except for CABG in Study I 1998 to 2002).

Surgical procedure	Number of patients	Claimants (% of patients)		Compensated claimants (% of claimants)	
CABG (Study I)	17 834	427	(2.4%)	84	(20%)
CABG (Study IV)	20 500	413	(2.0%)	75	(18%)
THA (Studies II and III)	16 646	408	(2.5%)	198	(49%)
TKA (Studies II and III)	17 535	437	(2.5%)	182	(42%)
THA (Study IV)	17 506	432	(2.5%)	205	(47%)
TKA (Study IV)	18 512	461	(2.5%)	190	(41%)

As a consequence, the constructed datasets constituted pooled cross-sections of patients covering the period 1998 to 2002 (Study I) and 1998 to 2003 (Studies II–IV).

The statistical package SAS version 9.1.3 and version 9.3 were used in linking and constructing the datasets as well as in producing some of the summary statistics. The statistical analyses were conducted by using STATA 7.0 (Study I) and Stata/SE 10.0 (Studies II–IV).

5.3 Data and methods in Studies I and II

In an analytical sense, the process of filing a claim and receiving compensation consists of two stages. First, the patient makes the decision whether she files a claim or not. Second, the patient either receives compensation or not, provided she has filed a claim. Consequently, in the second stage, data are confined to patients who filed a claim, as receiving compensation is conditional on this.

Reflecting further on the second stage, the analysis must be capable of dealing with, firstly, those cases where only one (e.g. infection injury) of seven criteria have qualified a successful claim based on the Patient Injury Act (Study I), and secondly, those cases where two or more criteria have qualified the claim (Study II). In the former situation, the appropriate statistical method for analysing factors associated with compensation is logistic regression analysis with the dependent variable having the value of 1 if the patient obtained compensation and 0 if she did not. However, in cases where the study sample comprises claims that have qualified for compensation on the basis of two or more of the seven criteria, the appropriate statistical method is multinomial logistic regression analysis, which allows for different criteria for compensation (Figure 9). Furthermore, such a method may offer health care providers and funders more detailed information on the types of compensable injuries and thus enable them to assume or demand more specific actions for improving patient safety.

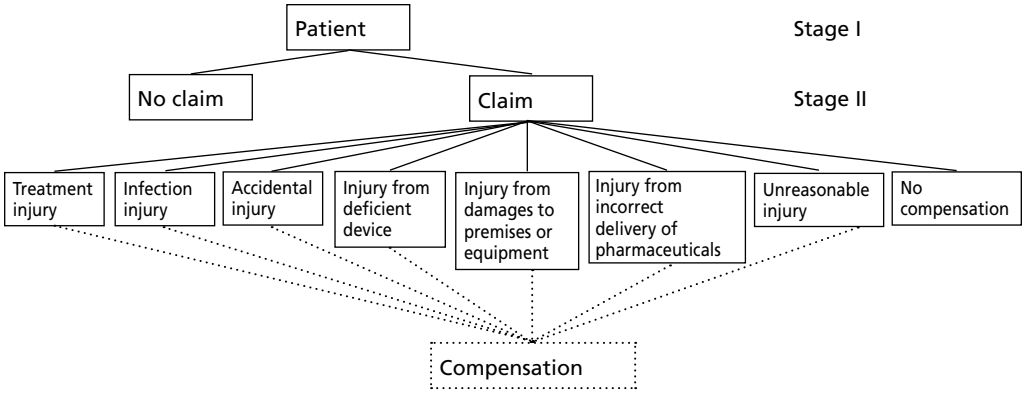

Figure 9. The claims filing process.

Consequently, in the first-stage statistical analysis of Study I, the dependent variable expressed whether the patient had filed a claim or not, and in the second-stage, whether the patient received compensation or not. In the first stage of Study II, the dependent variable was defined similarly to Study I, but in the second stage of Study II, the dependent variable that expressed receiving compensation was given one of three values: 1 if the patient received compensation for a treatment injury, 2 if the patient obtained compensation for an infection injury, and 0 if the patient did not obtain any compensation, with the latter being the reference category. (Figures depicting the stages in the statistical analyses can be found in the original publications.)

The explanatory variables were factors that were assumed to influence the filing of claims and receiving compensation and consequently comprised both patient- and hospital-level variables (Table 7). They were constructed from information available from the Hospital Discharge Register with the exception of the productivity indicator, which was obtainable from the Hospital Benchmarking database (Study I).

The primary patient-level variables were age, sex, and comorbidities. The measurement and functional form of the age and comorbidity variables varied between Studies I and II. In the latter, comorbidities were quantified by the Charlson comorbidity index, an index that takes into account the number of certain types of medical conditions and weights them according to severity (Charlson et al. 1987). In this research, the index allowed for those comorbidities documented in the Hospital Discharge Register over the time period between 1987 and the admission prior to the CABG, THA, or TKA admission (in the case of CABG, the time period was eleven years before the CABG admission). The latter admission's comorbidities were ignored so as not to take in any complications.

In contrast, comorbidities in Study I were defined largely in accordance with the EuroSCORE (Roques et al. 1999). The advantage of using such an approach was

that it selected those comorbidities that entail a risk especially in the case of CABG. However, the ten dummy variables initially defined for these comorbidities had to be united into one simple binary variable, referred to here as "risk diagnosis", because the number of explanatory variables was then too large in relation to the outcome value of 1 of the dependent variable. Consequently, the risk diagnosis variable obtained the value of 1 if the patient had at least one of the predefined comorbidities and the value of 0 if she had none.

The functional form of the age variable was determined in part empirically and in part based on previous knowledge of the relation of age with claims and clinical outcomes. Consequently, in regard to CABG (Study I), age was measured in terms of a dummy variable with the value of 1 if the patient's age was 75 years or more. In contrast, with regard to THA and TKA (Study II), the age variable seemed to correlate with the "cemented" variable depending on how age was defined. For instance, if age was measured as a dummy variable with the value of 1 for patients over 75 years or more, correlation with the cemented variable appeared, whereas if age was measured as a dummy variable with the value of 1 for patients 65 years or more, such a correlation did not emerge. As a consequence, an age of 65 or more was the chosen functional form.

Since the type of prosthesis is known to affect the outcome of THA and TKA, prosthesis type was taken into account by two variables "cemented" and "hybrid". Further, with regard to THA and TKA, the patient's experience with a prior contralateral arthroplasty was assumed to have an effect on both the patient's decision to file a claim and on the Patient Insurance Centre's decision on compensation. Prior experience means that the patient and the Centre are likely to have increased information on the risks and expected outcome. To take account of this, a variable was introduced to depict whether the patient had had a previous similar operation. In regard to claims following CABG, however, a previous similar operation is probably of lesser importance, as a clearly smaller rate of CABG patients had had previous operations compared to THA and TKA.

It is uncertain to what extent patients, health professionals, and patient ombudsmen have been aware of the legislative amendment to the Patient Injury Act in 1999 or considered it in their claims decisions or in recommendations for patients to pursue a claim. Nevertheless, the amendment may have had a significant impact on the chances of a patient obtaining compensation, in particular in cases involving an infection injury. Consequently, a dummy variable came into the statistical analyses to indicate whether the patient had been operated on before or after the change in the Patient Injury Act.

Bilateral arthroplasty was tested as an additional explanatory variable in the statistical analyses on THA and TKA but omitted due to its insignificance.

Hospital characteristics that were examined were volume and productivity, for the reason that previous research has suggested an association exists between volume and quality, although as of yet not entirely confirmed (Newhouse 1970, Chow-

dhury et al. 2007). Furthermore, such variables are important to investigate because they can be affected by policy-makers.

The productivity variable included in Study I was the index obtainable from the Hospital Benchmarking database for surgery departments and was computed as the sum of severity-adjusted admissions and outpatient visits divided by their costs, with both the nominator and the denominator comprising values at the surgery department level.

Unfortunately, productivity indexes were not available from the Hospital Benchmarking database for those large health centres that perform arthroplasty surgery in Finland and were not therefore included in studies on THA and TKA. Nevertheless, the Hospital Discharge Register allowed for the computation of volume. Expressing volume in terms of three distinct dummy variables (hospital with less than 200 arthroplasties, hospital with 200 or more but less than 300 arthroplasties, and hospital with 300 or more arthroplasties per year) proved to be the best functional form compared to several other alternatives – such as volume in absolute numbers or volume squared – because the functional form could not be properly tested due to the small number of high-volume hospitals. Furthermore, the limit of 200 operations coincided with the minimum target number of arthroplasties to be performed by an individual hospital per year as recommended by the Ministry of Social Affairs and Health in Finland (Ministry of Social Affairs and Health 2001).

5.4 Data and methods in Study III

Three indicators reflecting the quality of arthroplasty surgery were created by gathering information from the Hospital Discharge Register on each patient, whether she had had a revision within five years of primary arthroplasty (procedure codes NFC* and NGC*, for hip and knee, respectively), a deep infection within a year of a primary arthroplasty (diagnosis code T84.5), or a readmission to a hospital within fourteen days of discharge (counting also an out-of-hours visit as a readmission). This patient-level information was turned into hospital-level quality indicators following the formation of the indicators developed by the study on costs and outcomes of arthroplasty surgery in Finland (Mäkelä et al. 2011). Consequently, an indicator was defined as the expected number of observations for the outcome in question (revision, infection, or readmission) divided by the observed number of observations for the outcome in question, both at hospital level, and finally multiplied by 100. The observed number was the actual amount of observations obtainable from the summation of individual observations by hospitals. In contrast, the expected value was obtainable by estimating a regression equation where the dependent variable was a binary variable indicating whether the patient had the outcome in question or not and the explanatory variables were age, sex, comorbidities, bilateral operation, and previous contralateral operation (except for deep infection,

Table 7. Variables and the hypothesised direction of the association between the dependent and explanatory variables.

Explanatory variable	Description	Hypothesised sign			Study
		Filing a claim	Receiving compensation	Health care costs	
Patient-level variable					
Age over 65	Dummy variable, if age over 65=1	-	-		II, III
Advanced age	Dummy variable, if age 75 years or more=1	-	-		I
Age	Count variable, age in years			+	IV
Sex/Male	Dummy variable, if male=1	-	+	-	I-IV
Risk diagnosis	Dummy variable, if patient had one of the predefined comorbidities assumed to affect outcome of CABG adversely	+	-		I
Charlson comorbidity index	Count variable, takes into account selected comorbidities and weights them according to severity	+	-	+	II-IV
Cemented	Dummy variable, if both components of the prosthesis cemented=1	-	-		II, III
Hybrid	Dummy variable, if either component of the prosthesis cemented and other not=1				II, III
Previous operation	Dummy variable, if a previous similar operation (contralateral in the case of THA and TKA) previously=1	+	+	-	II-IV
Admission before change in law	Dummy variable, if admitted for CABG, THA, or TKA before the amendment to the Patient Injury Act=1, otherwise=0)	+	+		I-III
Revision unknown	Dummy variable, if side of revision unknown=1	+	+		III
Claimant	Dummy variable, if patient filed a claim=1			+	IV
Compensated claimant	Dummy variable, if patient obtained compensation=1			+	IV
Hospital-level variable					
Productivity	Continuous variable, productivity of the surgery department in which patient's CABG took place	+	+		I
Volume <200	Dummy variable, if operated at a hospital with less than 200 THAs (TKAs) per year=1, reference category				II, III
Volume 200-300	Dummy variable, if operated at a hospital with more than 200 but less than 300 THAs (TKAs) per year=1	-	-		II, III
Volume >300	Dummy variable, if operated at a hospital with more than 300 THAs (TKAs) per year=1	-	-		II, III
Revision indicator	Continuous variable, five-year revision rate at hospital (applied both as risk-adjusted and unadjusted with one- and six-year values)	+	+		III
Infection indicator	Continuous variable, one-year deep infection rate at hospital (applied both as risk-adjusted and unadjusted with one- and six-year values)	+	+		III
Readmission indicator	Continuous variable, 14-day readmission rate at hospital (applied both as risk-adjusted and unadjusted with one- and six-year values)	+	+		III

for which only age, sex, and comorbidities were included). Comorbidities consisted of twelve disease groups, for each of which a dummy variable with the value of 1 was given if the patient had a comorbidity that could be categorized under such a group (Appendix 4).

The above method was applicable also to the computation of observed and expected values of claims when assembling two hospital-level "claims indicators", one for filed claims and one for compensated claims. These were necessary for the calculation of correlations between claims and the quality indicators at the hospital-level.

During the course of Study III, it appeared that information on the laterality of 457 THA and TKA revision arthroplasties was unavailable; this information was missing both from the Hospital Discharge Register as well as the Finnish Arthroplasty Register. This meant that there was no way to determine whether the revision for these patients was a revision of the arthroplasty comprised in our dataset or the contralateral arthroplasty. The problem was solved by assuming these patients did not have a revision and by introducing a dummy variable "revision unknown" and giving it the value of 1 if the laterality of patient's revision was unknown.

The statistical analyses consisted of 1) calculation of correlations 2) logistic regression analyses. The former were conducted on hospital-level data, while the latter were conducted on patient-level data. The latter developed the statistical models of Studies I and II further by introducing the quality indicators into the patient-level analyses. However, the statistical analyses were conducted on the entire patient-level dataset without restricting it in the second stage to those patients who had filed a claim. The reason was that here the main aim was to investigate the impact of adding the quality variables to the previously drawn statistical model and to assess the total effect of the quality indicators on filing a claim and receiving compensation. Consequently, the dependent variable was a binary variable describing whether the patient had filed a claim or not, and in a second regression analysis, whether the patient received compensation or not. If filing a claim or receiving compensation were statistically significantly affected by the quality indicators, this would mean that certain levels or aspects of hospital care quality contribute to the occurrence of claims and/or compensations.

Study III went on to consider whether a claims indicator would have all of the characteristics required of a performance indicator: feasibility, reliability, criterion validity, possibility of risk adjustment, sensitivity to change, easy interpretation, acceptability by health professionals and other actors, no manipulation by providers, possibility to mitigate adverse effects, usability by different actors, monitoring and management by public authority, and suitability for political and organizational context (Smith et al. 2008).

5.5 Data and methods in Study IV

The dependent variable in Study IV consisted of a continuous variable comprising data on patients' CABG, THA, and TKA admission costs, and in a subsequent analysis, data on patient's one-year health care costs. These cost variables were constructed by the PERFECT project on the basis of data from the Hospital Discharge Register. The project had computed costs for each admission included in the project data based on Diagnostic Related Groups, while controlling for the length of stay (Peltola et al. 2011). These DRG costs were used in Study IV for the analyses on CABG.

In regard to THA and TKA, however, only one distinct DRG exists for THA and TKA, so that a different approach to calculating costs had to be taken. This came from using patient-level real cost data from one hospital district in Finland and modelling the effect of several explanatory variables on the cost of patient's arthroplasty admission (beforehand, the price of the prosthesis had been subtracted from the admission cost) (Peltola et al. 2011). The explanatory variables were factors assumed to influence costs such as length of stay and place of care following discharge (Peltola et al. 2011). Subsequently, the obtained coefficients were used to calculate the cost of THA and TKA admissions elsewhere in the country. Finally, the price of the prosthesis was added to each patient's cost estimate.

The PERFECT project made use of the health care standard unit costs in Finland (Hujanen et al. 2008) in the calculation of one-year health care costs following admission for CABG, THA or TKA. The admission costs for these procedures and the costs of the patient's hospitalisations and outpatient visits to specialised health care providers following the procedures for a one-year period were summed to obtain one-year health care costs. The costs of primary and private outpatient visits as well as the costs of pharmaceuticals purchased by patients in outpatient care during the year were not included.

Both surgery admission and one-year costs were deflated for 2008 using the public sector price index produced by Statistics Finland.

The explanatory variables consisted of two cumulatively defined dummy variables that represented the patient's claimant status: the first was given a value of 1 if the patient had filed a claim, and the second was given a value of 1 if the patient had received compensation.

The other explanatory variables included patient's age as measured in years, sex, comorbidities as measured by the Charlson comorbidity index, and a previous similar operation. Further included were hospital and year fixed effects, while the type of prosthesis was not included, as the type of prosthesis was already taken into account by the inclusion of the price of the prosthesis in the calculation of costs.

Study IV applied a generalized linear model with a gamma distribution and a log-link function due to the highly skewed distribution of costs (Figures 10a–f).

Figures 10a.–10f. Distribution of surgery and one-year health care costs of CABG, THA, and TKA patients.

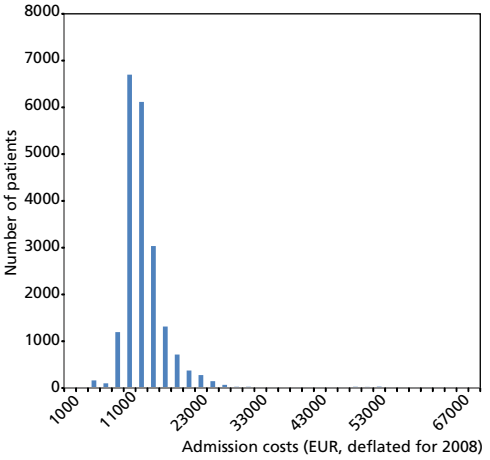

Figure 10a. Distribution of CABG admission costs of patients operated between 1998 and 2003.

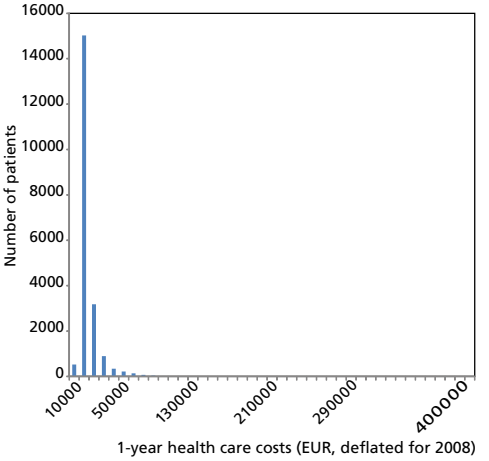

Figure 10b. Distribution of patients' 1-year health care costs following CABG performed between 1998 and 2003.

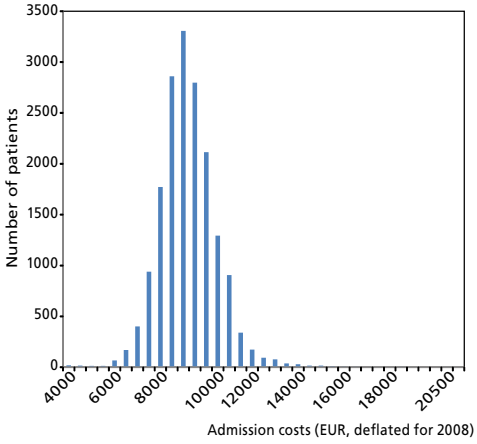

Figure 10c. Distribution of THA admission costs of patients operated between 1998 and 2003.

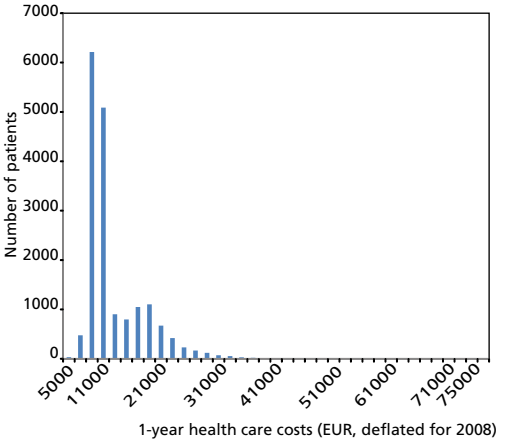

Figure 10d. Distribution of patients' 1-year health care costs following THA performed between 1998 and 2003.

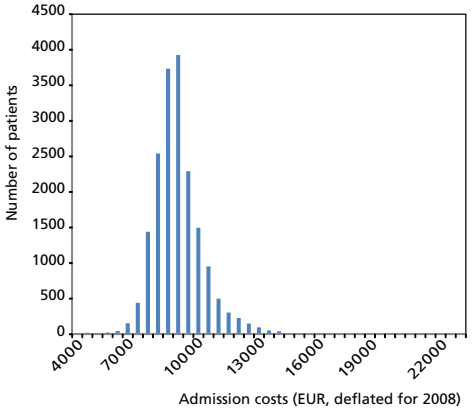

Figure 10e. Distribution of TKA admission costs of patients operated between 1998 and 2003.

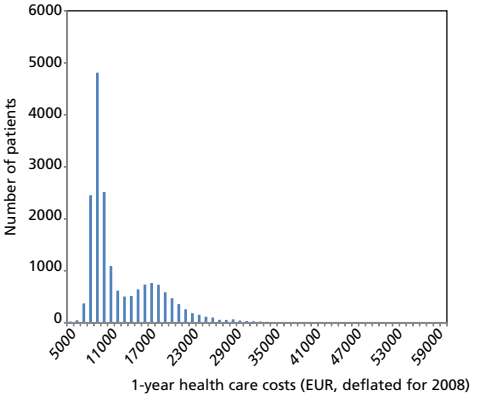

Figure 10f. Distribution of patients' 1-year health care costs following TKA performed between 1998 and 2003.

6 Results

6.1 Descriptive analysis of patient injury claims (J.J. et al. unpublished results)

Section 6.1 presents unpublished results derived from the linking of data comprising specialized health care in 2000 and 2002, while Sections 6.2–6.4 present results from the original four studies.

The combined dataset for the years 2000 and 2002 obtained from linking Patient Insurance Centre data with data from the Hospital Discharge Register would have allowed various kinds of descriptive analyses, but here only the most interesting of those obtainable only via the linking of the datasets are presented.

The share of admissions involving claims in the year 2000 was 0.3% (Table 8). The rate of claims related to day surgery was slightly less than this, with 0.2% of day surgeries involving a claim. Out-of-hours visits as well as outpatient visits produced a claim in 0.06% and 0.01% of visits, respectively. With regard to compensated claims, 0.1% of admissions generated a compensated claim, while this share for the other service types was somewhat less than this. When the distribution of claims was viewed across service types, then about 70% of claims, whether filed or compensated, were related to inpatient care. Day surgery, outpatient visits, and out-of-hours care produced about 10% of all claims each. The distributions of claims across service types were fairly similar for the year 2002. However, the rate of claims per admissions, day surgeries, and outpatient visits were not calculated for 2002, as the linkage rate of claims for this year was only 72%.

The medical speciality that generated most of both filed and compensated claims was surgery followed by gynaecology and obstetrics as well as internal medicine (Table 9). The specialities with the least number of claims were general medicine, dental diseases, skin diseases, physiatrics, and psychiatry. The distribution of claims between specialities from 2000 to 2002 did not change much.

The DRG group with the clearly highest number of both filed and compensated claims in both 2000 and 2002 was 209 (major joint and limb reattachment procedures of the lower extremity), which comprises total primary arthroplasties of the hip and knee (Table 10). CABG (DRG 107) ranked fifth in 2000 and eighth in 2002 with regard to filed claims, but ranked much lower with regard to compensated claims in both years. Other DRGs that frequently produced claims were procedures of the back and extremities as well as gynaecological DRGs.

Table 8. Distribution of filed and compensated claims between inpatient care, day surgery, and outpatient care in Finland in 2000 and 2002 (care provided by public hospitals excluding health centres providing specialised health care).

Type of service	Year 2000*							Year 2002**			
	Number	Claims	Claims as a share of all claims (%)	Claim rates (%)	Compensated claims	Compensated claims as a share of all compensated claims (%)	Compensated claim rates (%)	Claims	Claims as a share of all claims (%)	Compensated claims	Compensated claims as a share of all compensated claims (%)
Inpatient admission	817 180	2843	68	0.348	844	71	0.103	2071	69	704	70
Day surgery	151 337	365	9	0.241	100	8	0.066	299	10	126	13
Outpatient visit	4 488 561	458	11	0.010	121	10	0.003	274	9	69	7
Out-of-hours visit	850 828	518	12	0.061	132	11	0.016	362	12	107	11
Total		4184	100	-	1197	100	-	3006	100	1006	100

* 99% of filed claims linked with Hospital Discharge Register and Benchmarking data.
** 72% of filed claims linked with Hospital Discharge Register and Benchmarking data; claim rates per admissions/day surgeries/visits not reported for 2002 because only 72% of data linked.

Table 9. Distribution of filed and compensated claims between medical specialities in Finland in 2000 and 2002 (care provided by public hospitals excluding health centres providing specialised health care in Finland).

Medical speciality	Year 2000*				Year 2002**			
	Claims	%	Compensated claims	%	Claims	%	Compensated claims	%
Cancer diseases	41	1.0	11	0.9	34	1.1	5	0.5
Dental, mouth, and jaw diseases	22	0.5	10	0.8	14	0.5	6	0.6
Ear, nose, and throat diseases incl. phoniatrics	123	2.9	41	3.4	93	3.1	31	3.1
Eye diseases	142	3.4	32	2.7	151	5.0	51	5.1
General medicine	6	0.1	2	0.2	3	0.1	0	0.0
Gynaecology and obstetrics	366	8.7	115	9.6	274	9.1	99	9.8
Internal Medicine	376	9.0	79	6.6	229	7.6	57	5.7
Lung diseases	37	0.9	3	0.3	25	0.8	4	0.4
Neurology	101	2.4	21	1.8	51	1.7	5	0.5
Neurosurgery	113	2.7	29	2.4	92	3.1	23	2.3
Paediatrics	99	2.4	22	1.8	51	1.7	18	1.8
Physiatry	26	0.6	2	0.2	13	0.4	3	0.3
Psychiatry	30	0.7	3	0.3	18	0.6	5	0.5
Skin and sexually transmitted diseases	19	0.5	5	0.4	7	0.2	1	0.1
Surgery	2671	63.8	820	68.5	1951	64.9	698	69.4
Unknown	12	0.3	2	0.2	0	0.0	0	0.0
Total	4184	100.0	1197	100.0	3006	100.0	1006	100.0

* 99% of filed claims linked with Hospital Discharge Register and Benchmarking data.
** 72% of filed claims linked with Hospital Discharge Register and Benchmarking data.

Table 10. Top 20 DRGs for which claims were filed and compensated in Finland in 2000 and 2002 (care provided by public hospitals excluding health centres providing specialised health care in Finland).

Year 2000*				2002**			
DRG	DRG name	Claims	Compensated claims	DRG	DRG name	Claims	Compensated claims
209	Major joint & limb reattachment procedures of lower extremity	255	102	209	Major joint & limb reattachment procedures of lower extremity	299	115
219	Lower extremity & humerus proc except hip, foot, femur age > 17, w/o cc	151	59	215	Back & neck procedures w/o cc	86	28
215	Back & neck procedures w/o cc	111	36	225	Foot procedures	70	39
222	Knee procedures w/o cc	87	22	227	Soft tissue proceudes w/o cc	69	24
107	Coronary bypass w/o cardiac catheterization	85	8	359	Uterine & adnexa proc for ovarian or adnexal non-malignancy w/o cc	69	27
359	Uterine & adnexa proc for ovarian or adnexal non-malignancy w/o cc	71	24	39	Lens procedures with or without vitrectomy	62	26
227	Soft tissue procedures w/o cc	67	18	222	Knee procedures w/o cc	58	19
225	Foot procedures	63	19	107	Coronary bypass w/o cardiac catheterization	49	9
39	Lens procedures with or without vitrectomy	62	14	219	Lower extremity & humerus proc except hip, foot, femur age > 17, w/o cc	39	18
229	Hand or wrist proc, except major joint proc, w/o cc	58	25	1	Craniotomy age > 17 except for trauma	36	7
224	Shoulder, elbow or forearm proc, except major joint proc, w/o cc	56	19	214	Back & neck procedures w cc	36	16
290	Thyroid procedures	54	25	224	Shoulder, elbow or forearm proc, exc major joint proc, w/o cc	36	12
211	Hip & femur procedures except major joint, age > 17, w/o cc	50	18	290	Thyroid procedures	36	24
232	Arthroscopy	44	15	229	Hand or wrist proc, except major joint proc, w/o cc	31	15
1	Craniotomy age > 17 except for trauma	43	9	468	Extensive o. r. procedure unrelated to principal diagnosis	30	9
8	Peripheral & cranial nerve & other nervous system proc w/o cc	41	16	119	Vein ligation & stripping	28	6
119	Vein ligation & stripping	41	6	232	Arthroscopy	28	17
162	Inguinal & femoral hernia procedures, age > 17 w/o cc	36	8	358	Uterine & adnexa proc for ovarian or adnexal non-malignancy w cc	28	16
149	Major small & large bowel procedures w/o cc	34	5	148	Major small & large bowel procedures w cc	24	11
155	Stomach, esophageal & duodenal procedures, age > 17 w/o cc	33	12	149	Major small & large bowel procedures w/o cc	24	12

* 99% of filed claims linked with Hospital Discharge Register and Benchmarking data.
** 72% of filed claims linked with Hospital Discharge Register and Benchmarking data.

w=with w/o = without cc=comorbidities, complications
proc=procedure o.r. = operating room

6.2 Factors associated with claims and compensations (Studies I and II)

Comparing results between CABG, THA, and TKA obtained in Studies I and II, there appeared both differences and similarities (Table 11). A common feature was that elderly compared to younger patients and men compared to women were less likely to file a claim (with the exception of TKA, where being male did not emerge as statistically significant). Moreover, the probability of filing a claim was significantly increased if patients had one or more comorbidities or more severe comorbidities (labelled as risk diagnosis in Study I). A further significant result was that replacing a hip joint with a cemented prosthesis reduced the tendency to file a claim compared to an uncemented one.

When it came to the probability of obtaining compensation, the above differences between the patient groups were in part reversed (Table 11). Now, female compared to men and patients with one or more comorbidities compared to patients with no comorbidities had a lower chance of receiving compensation following CABG. Furthermore, following TKA, men as opposed to women had an increased relative risk of a compensable infection injury versus no compensation, while age over 65 years compared to age 65 years or less was associated with a decreased relative risk of a compensable treatment injury versus no compensation.

The amendment to the Patient Injury Act in 1999 had an impact on filing a claim and receiving compensation only in the case of CABG. If the patient's CABG admission had started before the amendment took effect, she was more likely to obtain compensation than if her CABG admission had started after the amendment took effect.

Patient's experience with an earlier similar arthroplasty did not seem to be a strong predictor of a claim or compensation, because only in the case of TKA was a previous operation associated with a statistically significant increased relative risk of an infection injury.

Concerning hospital-level variables, the relative risk of a compensated treatment injury was lower for hospitals with an annual volume of over 300 TKAs compared to hospitals with an annual volume of less than 200 TKAs. In regard to THA, a volume between 200 and 300 THAs per year as opposed to a volume lower than 200 THAs per year increased the odds of filing a claim. With regard to claims and compensations following CABG, none of the hospital-level variables were statistically significant.

Adding hospital fixed effects to each of the three surgical procedure's statistical model did not change the above results (not reported here). As concerns the effect of individual hospitals with regard to CABG, one out of six hospitals showed a statistically significantly increased probability of filing a claim, but none of the hospitals had a statistically significant association with receiving compensation. Following THA and TKA similarly, dummy variables for the 35 individual hospitals did not

Table 11. Main results in Studies I-II.

Variable	CABG		THA			TKA		
	Claim (OR)	Compensation (OR)	Claim (OR)	Compensation for treatment injury (RRR)	Compensation for infection injury (RRR)	Claim (OR)	Compensation for treatment injury (RRR)	Compensation for infection injury (RRR)
Age (CABG: age 75 or more; THA/TKA: age over 65)	0.71*	0.75	0.57***	0.64	1.03	0.65***	0.57*	0.96
Sex	0.66***	2.08*	0.74**	1.08	1.83	0.82	0.74	2.07*
Risk diagnosis/ Charlson comorbidity index	1.29*	0.52*	1.17**	1.10	0.86	1.14*	0.99	0.99
Cemented			0.77*	1.25	2.00	1.70	0.37	0.26
Hybrid			0.92	0.93	1.13	2.23	0.12	0.39
Previous operation			1.15	1.58	1.23	0.80	2.46	4.02**
Admission before change in law	1.36**	3.89***	0.96	1.05	2.02	0.92	1.39	1.86
Productivity[a]	2.33	4.56						
Volume 200-300			1.29*	0.97	0.95	1.02	0.64	1.49
Volume >300			1.02	1.03	0.86	0.85	0.24*	0.97

* = p<0.05 ** = p<0.01 *** = p<0.001

a Volume of CABG was tested in place of productivity but it was statistically insignificant.

emerge as statistically significant in relation with receiving compensation, while one hospital compared to the reference hospital reduced the probability of filing a claim.

In Study II, testing the effect of partial knee replacement by adding a dummy variable for such an operation indicated that a patient would be more likely to receive compensation for a treatment injury if the operation had involved a partial rather than a total replacement (not reported here). Possible explanations could be the surgeon's lesser experience with the procedure or that malposition occurs more frequently in the case of a partial prosthesis. However, this variable correlated significantly with age and changed the estimate for age from statistically significant to insignificant. This might indicate multicollinearity, which means that it cannot be concluded for certain if an increase [decrease] in the dependent variable (compensation), following an increase [decrease] in partial replacement derives solely from the change in the latter or from a change in age or from a change in both (all other variables held constant). In contrast, patellar resurfacing did not have a statistically significant effect on either the filing of claims or compensation. In consequence, variables indicating partial knee replacement and patellar resurfacing were omitted from the final analyses.

6.3 Association between claims and quality (Study III)

With indicators risk-adjusted, a statistically significant correlation emerged between the claims indicators and the five-year revision rate as well as between the claims indicators and the one-year deep infection rate (Table 12). When the indicators were unadjusted or constructed to include only one single value for the entire six-year study period instead of comprising a value for each year, the strength and statistical significance of the correlation remained largely similar (precise coefficients in the original publication). Furthermore, with regard to TKA, the filed claims indicator also correlated statistically significantly with readmissions.

When the quality indicators were inserted into the patient-level data on THA and TKA as part of the logistic regression analysis, the revision and the infection indicators had a positive and statistically significant relation with both a claim and compensation. The odds of filing a claim increased by 0.2% and the odds of receiving compensation by 0.3 %, if the revision indicator increased by one. A one-unit increase in the infection indicator increased the odds of both a claim and compensation by 0.1%.

Study III further assessed that a claims indicator would possess five of the characteristics required of a performance indicator: feasibility, reliability, usability by different actors, monitoring and management by the public authority as well as suitability for political and organizational context. It would also fulfil another four characteristics in part: criterion validity, possibility of risk adjustment, sensitivity

Table 12. Association between quality indicators and filed claims as well as compensated claims (quality indicators and "claims indicators" risk-adjusted for patient characteristics by hospital and year) (Study III).

Data	Variable	Quality indicators (at hospital-level)		
		5-year revision rate	1-year deep infection rate	14-day readmission rate
Hospital-level data (Pearson correlation coefficient)	Filed claims indicator			
	THA	0.21**	0.27***	0.06
	TKA	0.30***	0.21**	0.20**
	Compensated claims indicator			
	THA	0.23**	0.26***	0.06
	TKA	0.25***	0.33***	0.00
Patient-level data, THA and TKA combined (Odds Ratio)	Claim	1.002***	1.001*	1.001
	Compensation	1.003***	1.001**	1.000

* = p<0.05 ** = p<0.01 ***= p<0.001

to change, and possibility to mitigate adverse effects. However, the indicator would perform badly with regard to three requirements: easy interpretation, acceptability by health professionals and other actors as well as no manipulation by providers.

6.4 Health care costs of patient injury claimants and non-claimants (Study IV)

Study IV compared the health care costs of three patient groups: patients who did not file a claim, patients who filed a claim but were denied compensation, and patients who filed a claim and received compensation.

The mean risk-adjusted admission costs of a claimant denied compensation were statistically significantly higher than those of a non-claimant: EUR 3660 (29%) following CABG, EUR 418 (5%) following THA, and EUR 359 (4%) following TKA. In contrast, the cost differential (risk-adjusted) between a compensated claimant and a claimant denied compensation was smaller than that between the two first patient groups and statistically insignificant: EUR 1186 (7%) following CABG, EUR 28 (0.3%) following THA, and EUR 112 (1%) following TKA.

One-year risk-adjusted health care costs of a claimant denied compensation compared to a non-claimant were EUR 12 990 (71%) higher following CABG, EUR 310 (3%) higher following THA, and EUR 377 (-3%) smaller following TKA. However, in regard to THA and TKA, the cost differentials were statistically insignificant.

One-year risk-adjusted health care costs of a compensated claimant compared to a claimant denied compensation were EUR 6388 (20%) higher following CABG, EUR 151 (-1%) smaller following THA, and EUR 466 (4%) higher following TKA. Again, the cost differentials in regard to THA and TKA were statistically insignificant, while those in regard with CABG, were statistically significant.

7 Discussion

7.1 Strengths and weaknesses of the patient injury insurance scheme in Finland and suggestions for its further development

The virtuous features of no-fault schemes cited in the literature also apply to the patient injury insurance scheme in Finland: the administrative costs of the system are rather low, filing a claim is in principle easy, the processing of claims is rather rapid on average, and at least in theory, the scheme provides a good starting point for improving patient safety because an individual health professional is not blamed for any wrongdoing and the system allows for compensation in the case of system deficiencies (Kessler et al. 2006, Bismark and Paterson 2006, Kachalia et al. 2008). These are important reasons for maintaining the no-fault scheme in Finland. Nevertheless, the scheme has shortcomings. These are discussed below, while some approaches to tackle these are also proposed.

The Patient Insurance Centre reports that on average the rate of compensated claims has been around 30% of all filed claims. The rate is low compared to figures from Sweden, where the compensation rate has been 49.5% (Pukk-Härenstam et al. 2008), and the United States, where compensation rates have varied from 43% to 62%, (Cheney et al. 1989, Farber and White 1991, Taragin et al. 1992, Brennan et al. 1996, Studdert et al. 2006). The differences in compensation rates may be explained by various reasons such as differences in the incidence of adverse events and compensation criteria. At the same time, the higher refusal rate in Finland may originate from the Patient Insurance Centre perhaps not always being the best body to handle some of the filed claims. Some claims may be better directed as complaints to other parts of the health care system, such as the administration of the patient's hospital or the Regional State Administrative Agencies. This is actually the reason the Patient Insurance Centre itself has given for the high refusal rate (Mikkonen 2007).

Nevertheless, with the compensation criteria applied in Sweden and Finland being almost similar (Palonen et al. 2005), the large deviation of the Finnish figure from the Swedish one is puzzling. Further questions about the low compensation rate in Finland are raised by the results of Study IV. These indicate that health care costs, and consequently, health care utilization between compensated claimants and claimants denied compensation do not differ (with exceptions). This further implies that the severity and/or nature of adverse events and/or other motivations for a claim between the two claimant groups are not any different.

The claims rate for inpatient admissions to specialized health care was identified in this research as 0.3%. This is close to the 0.1% and 0.2% observed in Sweden, the United States, and New Zealand (Localio et al. 1991, Studdert et al. 2000, Bis-

mark et al. 2006b, Pukk-Härenstam et al. 2008). The reason for the slightly higher rate in Finland might be that health centres providing specialized health care were excluded from the descriptive analysis, so that the data possibly comprised more complex specialized health care than if the health centres had been included. Another and probably more plausible reason is that the linking of claims for the year 2000 comprised a number of very loose criteria, some of which may not have been quite correct after all.

Although the 0.3% entails uncertainties, it is an extremely low figure compared to the approximate 10% of hospitalized patients known to suffer adverse events (de Vries et al. 2008) and to the respective figure of 12.3% found in Sweden, where as many as 70% of the adverse events were considered avoidable (Soop et al. 2009). If such a large number of patients suffer adverse events, of which a large fraction would be avoidable, it is further perplexing why the majority of claims in Finland are disqualified.

The principal judgment the Patient Insurance Centre has to make when deciding on compensation is whether an adverse event was preventable or not. This is often highly challenging. Because such a decision is demanding and often subject to disagreement even among experts, it would be important to find ways to facilitate the Centre's decision-making and aim at considering alternative and hopefully less demanding criteria.

Since the Patient Insurance Centre may compensate for deficiencies in the overall performance of the patient's care and the functioning of her treatment process, experts at the Centre presumably not only analyze the performance of individual professionals but also the patient's entire treatment process. It is not known, however, to what extent the experts construct and analyse the sequence of events in its entirety, including working environment and other organizational factors that are known to contribute to adverse events (Vincent 2003) and with how much thoroughness and carefulness. Such a retrospective diligent construction of the progression of events is in many cases necessary, because identifying just one or two contributory factors rather than the entire sequence of contributory factors can result in a very different notion of the course of events and consequently, a very different compensation decision.

It is not known whether the Finnish Patient Insurance Centre and compensation systems in other countries take advantage of models outlined for the analysis of adverse events (for instance, Taylor-Adams and Vincent 2012, "Canadian Patient Safety Institute" 2012). Neither has it been studied, to our knowledge, whether and to what extent such models would be applicable to the processing of claims and compensation decisions at all. Assessing the applicability of such models for compensation decisions might be valuable. Using a structured framework for identifying contributory factors would compel an explicit and specific expression of which one or several of the contributory factors identified was or were decisive in the patient's receipt of compensation and the amount of compensation payment. Moreover, such

an approach would serve as a basic structure for developing register data on claims and, due to preventability being such a difficult issue to tackle, facilitate assessing whether compensation criteria other than preventability would be applicable.

To what extent deficiencies in team work, working environment, and organizational characteristics - some of the factors to be considered in the above mentioned incident models - emerge from documents available to the Patient Insurance Centre is difficult to say. If the identification of such factors is not feasible from documents currently available to the Centre, then there is need to improve the availability of information. In fact, the need for additional and improved information for claims processing is indicated by a number of studies. For instance, interviews of patients have shown that patients are able to describe adverse events that are not observable from their medical records (Taylor et al. 2008, Weissman et al. 2008, Zhu et al. 2011). Consequently, medical records and other material available to experts at the Patient Insurance Centre may not expose all adverse events and contributory factors. Moreover, different data sources seem to uncover different adverse events so that adverse events that are apparent, for instance, from incident reporting systems or hospitals' administrative computer systems are not necessarily apparent from medical records and vice versa (Naessens et al. 2009, Levtzion-Korach et al. 2010). This implies that the Patient Insurance Centre should have at its disposal a combination of various information sources. Systems for measuring quality and patient safety are still at their early stages of development, but with their increased usability such information sources should be available also to the Patient Insurance Centre. The processing of claims might also incorporate in the most complex cases structured interviews (will be discussed later in more detail).

The most urgent alteration required within the Finnish patient injury insurance scheme, however, is an improvement in the patient's status. Currently, there is a clear imbalance between patients and professionals in the possibilities afforded during the claims process to express their views and experiences. The patient's perspective may be presented only by her short description of the injury (occasionally drawn up with the assistance of a lawyer or complemented by a physician's statement), while all the remaining parts of the process are influenced and shaped by highly educated professionals, predominantly the legal experts of the Patient Insurance Centre and physicians. The views and experiences of physicians enter the process at many stages: independent expert statements are issued by physicians, the account given by the provider involved in the injury is often given by a physician, and medical records are largely written by physicians.

The imbalance between patients and professionals and the lack of possibilities for patients to express their views and experiences and discuss these with professionals is a clear drawback of the Finnish patient injury insurance scheme and of no-fault schemes in general (Sloan and Hoerger 1991). A further shortcoming is that once the Patient Insurance Centre has decided on compensability, it sends the patient a letter with justifications for their decision that are, anecdotally, fairly gener-

al. This may leave the patient with many unanswered questions and misunderstandings. To obtain additional explanations the patient can ask the Patient Injuries Board for a re-evaluation of her case, but this cannot be a solution in the case of each claim.

Although the Patient Insurance Centre cannot obviously take responsibility for all the tasks that health professionals are supposed to perform following an adverse event—apology and explanations to the patient for why the adverse event occurred as well as reassurances that similar events will never occur again (Vincent et al. 1994)—the Centre is, nevertheless, in a position that enables it to give explanations.

In Finland, the general advice to patients is that patients should first discuss their case at the hospital or other organization they were treated at before pursuing a claim or complaint. Possibilities for such discussions, irrespective of whether patients pursue a claim or complaint, should be extended and improved and patients should be given the chance to obtain proper explanations for what went wrong. These are the situations in which perhaps the role of a patient ombudsman might be strengthened. A patient ombudsman cannot be expected to have the deep insight into all patient injury cases and the deep knowledge of medicine and the sequence of events that is often necessary for an understanding of the occurrence of adverse events. Nevertheless, their tasks could focus more towards organizing and facilitating open discussion between professionals and patients and, in practical terms, to arrange meetings at which there is a possibility for both sides to explain their views and experiences. A patient ombudsman could also make sure that adverse events emerging from such discussions are included within incident reporting systems or otherwise are taken into consideration by the health care organization.

Knowing how to bring patients' views and experiences into the processing of claims at the Patient Insurance Centre without substantially increasing resources is not an easy issue. Perhaps claims processing could establish a distinct review by a physician and lawyer who would examine the material contained in claims files from the patient's perspective and prepare arguments in favour of the patient's claim. A further arrangement would be to conduct interviews in which an expert of the Centre would discuss the patient's views and experiences with her and/or her relatives. Enabling health professionals and health care managers to be interviewed might also be worthwhile, as possible deficiencies in factors difficult to observe from medical records may come to light, such as flaws in the organization of care and working conditions. Because interviews are resource-intensive, these should perhaps be restricted to the most complicated cases.

Whether current resources at the Patient Insurance Centre are sufficient for investing the required time and effort into each claim and whether these would allow for the above-described extension of activities is not known. If an increase in the Centre's resources can markedly improve decision-making at the Centre (for instance, bringing improvements in accuracy and equity of compensability and amounts of compensation) or result in a visible improvement in patient safety within the health care system (for instance, utilization of material accumulated from

filed claims results in improvements in patient safety), or both, then an increase in the resources of the Centre might be justifiable.

Any considerations of appropriate resources should take into account the time needed for claims processing. The average time consumed for claims processing has been continuously being reduced, a fact the Patient Insurance Centre has repeatedly drawn attention to and may in principle be a favourable change, but if it impairs decision-making (for which there is no evidence so far), it may be questionable.

The feedback system of the Patient Insurance Centre (Mikkonen 2004, "Patient Insurance Centre" 2012) seems to be poorly known among health professionals and its effect on clinical work has not been studied. Neither is it known where the feedback within hospital districts actually goes to and whether clinicians who would benefit from it actually receive it. Apart from enhancing the use of the feedback system within hospital districts, the Patient Insurance Centre could consider directing the feedback system to Finnish medical specialist organizations. Furthermore, existing national performance measurement schemes (Linna and Häkkinen 2008, Häkkinen 2011) could incorporate indicators measuring the hospital-level rates of filed and compensated claims for selected surgical procedures such as hip and knee replacement. Obviously, general principles and case studies already communicated by experts of the Patient Insurance Centre (Palonen et al. 2005) and the Patient Injuries Board in the Finnish Medical Journal (for instance, Kaivola and Lehtonen 2012) are an important premise for distributing information on compensation decisions and enhancing discussion on them.

This research did not investigate monetary amounts of compensation payments mainly because of the imprecision entailed in the amount of future payments. Nevertheless, as an overall impression, compensation payments in Finland are low and perhaps do not compensate patients their losses in full. If compensation payments were larger, they might act as a stronger incentive for hospital districts to launch patient safety initiatives than what the payments currently do. Furthermore, the limit of EUR 200 under which compensable claims are not paid any compensation should be reconsidered. To compare, in 2010, the average reimbursement paid by the Social Insurance Institution to a patient for a visit to a private medical specialist was EUR 21.90, and there were altogether 3 million of these ("Kela", 2012).

Although the other task of tort systems is to act as an incentive for health professionals to put sufficient effort into preventing adverse events, research has indicated that tort systems actually do not constitute a strong incentive (summarized by Danzon 2000, Studdert et al. 2004, Sloan and Chepke 2008). At the same time, it has been argued that tort systems encourage behaviour of health professionals and health care organizations that is entirely opposite to the aims of patient safety activities, because the threat of being sued deters health professionals from reporting and being open about errors (Studdert et al. 2004). A related concern has been defensive medicine, with positive defensive medicine indicating a "supply of care that is unproductive for patients" and negative defensive medicine referring to the situation

"when providers decline to supply care that is productive for patients" (Kessler et al. 2006). It has been estimated that defensive medicine in the United States increases hospital spending from 5% to 9% (Kessler and McClellan 1996) and imposes on the health care system total costs of USD 46 billion (Mello et al. 2010). To what extent defensive medicine exists in other countries is not known, but if it does, it not only implies a waste of health care resources but also a possible unnecessary increase in patient safety incidents.

The patient injury insurance scheme in Finland does not perhaps constitute a strong incentive or an obstruction to promoting patient safety for the obvious reason that individual health professionals do not bear any direct consequences from patients' claims apart from possible reputation effects. Instead, a stronger influence on health professionals' behaviour might be the threat of lawsuits and disciplinary actions by the National Supervisory Authority for Welfare and Health, although the impact of these incentives has not been studied.

Nevertheless, research should focus on how the financial arrangements of the patient injury compensation scheme could be transformed into a stronger incentive for patient safety promotion. Such research should assesses 1) what kind and size of risk pool would be required in order for hospitals districts' premiums to remain fairly stable over time or at least be to some degree predictable 2) how should premiums be determined so that they create a financial incentive for injury prevention (for instance, should hospital districts continue to bear full liability or should this liability be at the hospital level or, if more insurance-like arrangements were introduced, how should premiums be determined), and 3) how can the two aforementioned be combined.

The withdrawal of the Helsinki and Uusimaa Hospital District from the current arrangements for financing compensation payments is understandable and justifiable in view of the problems described in Section 2.4. Whether other hospital districts will follow and take insurance coverage from private companies remains to be seen. If this happens, a scheme with insurance-like characteristics will replace the current full liability scheme with the advantage of premiums becoming more predictable. At the same time, possibilities to exploit hospital districts' full liability as an incentive for patient safety promotion will be lost.

The register data of the Finnish Patient Insurance Centre has developed on the basis of the needs of processing and paying claims rather than scientific research. To improve opportunities for such research and linkages with other register data, the Patient Insurance Centre register should take more advantage of the codes and categorizations adopted in other national health care registers and update them similarly. Furthermore, the register could be exposed to quality inspections and computer programs that check for the correctness of dates and codes. A fascinating idea would be to develop the register further along the lines of the database of the American Society of Anaesthetists (usage of the database described by Vincent et al. 2006). In such a case, the register would be extended to include more detailed information

on the nature, location (medical speciality, operating room, emergency, etc.), causes, group of health professional involved in the injury, patient-related contributing factors, and consequences of the injury as well as other possible factors that contributed to the injury (or if such information is not available, then with a note stating that information is unavailable). Collection of such information would have to be classified and coded in a uniform way and appraised by medical specialists or other experts, but it would have the great advantage of being usable for identifying the chain of factors that contributed to an injury and being more readily applicable to patient safety purposes.

The Patient Injury Act itself does not state whether health care providers' resources are to be taken into account in compensation decisions, but the Government Bill to amend the Patient Injury Act (Government Bill to Amend the Patient Injury Act 1998) mentions that scarce health care resources at the time of the injury may justify denial of compensation. This may in principle be a reason to decline every claim, since resources are always scarce! For instance, provider organizations responsible for an injury may be able to demonstrate that sufficient specialist nurses or physicians were not available for out-of-hours work, which led to the injury.

If scarce resources are the cause for an adverse event, the health economics literature suggests that such a situation should be handled between purchasers and providers of care on the basis of their contracts (Danzon 2000). If such a suggestion was followed in Finland, the Patient Injury Act should not take a stance on limited resources, while claims deriving from a lack of resources should be a matter to be resolved between municipalities and hospitals or hospital districts, and in the case of primary care, health centres. Whether such a proceeding would work within the health care system in Finland with many small municipalities being responsible for the organization and financing of health care is difficult to say but worth considering.

Addressing the current weaknesses of the patient injury insurance scheme and strengthening the patient's status would be worthwhile, as they would improve patient satisfaction with the health care system, clarify misunderstandings of both patients and health professionals, improve and facilitate decisions on compensations, and present a good opportunity for health professionals to learn and improve their practices.

7.2 Impact of patient characteristics on claims and compensations

Patient characteristics identified in this research as being associated with an increased tendency to file a claim may in part reflect situations in which the patient's increased risks of adverse events are realised (for instance, female gender with regard to CABG and comorbidities with regard to CABG, THA, and TKA), in part the patient's need to obtain compensation for economic losses (for instance, age), and

possibly other reasons. When it comes to the compensation of claims, the patient's risk factors, such as comorbidities and gender, seem to affect her chances of obtaining compensation in the case of infection injuries but not in the case of treatment injuries.

The finding that elderly patients were significantly less inclined to file a claim than younger or working-aged persons is similar to previous studies (Table 3) and possibly originates from the elderly having incurred smaller income losses from adverse events than working-aged patients (Bismark et al. 2006b). At the same time, adverse events caused for the elderly might perhaps be more difficult to discover due to an elderly person's health status being more delicate and the existence of multiple comorbidities (comorbidities were taken into account here but possibly not to a sufficient extent). A further reason could be that adverse events that happen to the elderly are more easily tolerated by patients themselves and their relatives as well as by health care personnel, or that the elderly are more satisfied with the care they receive than younger patients (Jaipaul and Rosenthal 2003). Yet, the result is worrying insofar as that adverse events in general are much more frequent among the elderly than among younger patients (Brennan et al. 1991a, Davis et al. 2002). A positive finding was, however, was that older age does not seem to reduce patients' chances of obtaining compensation (with the exception of treatment injury following TKA).

Male patients appeared to be less likely to file a claim but in some situations were more likely to obtain compensation than female patients. The instances in which men seem to have better chances of obtaining compensation are injuries involving an infection. The definition of a compensable infection injury states that the patient's current and past health status should be taken into consideration, which implies that patients with an increased risk of infection have a reduced possibility of obtaining compensation for an infection injury. This could explain the lower probability of female patients receiving compensation following CABG, because the majority of claims regarding CABG involved infection injuries and because females have an increased risk of adverse outcomes following CABG (Blankstein et al. 2005, but not confirmed in every study). With regard to TKA, where men were also more likely to receive compensation for an infection injury, the explanation is less clear. According to one study, following TKA the risk of infection is higher among men than women (Willis-Owen et al. 2010), while according to another study such a gender difference does not exist (Chesney et al. 2008). It is not possible to say on the basis of this research whether the gender differences in obtaining compensation following infection injury derive from differences in individual risks between men and women or from true inequities in obtaining compensation or both. Further research on patient groups or surgical procedures other than CABG, THA, or TKA is necessary to establish which is the case. If the gender difference turned out to derive from the definition of infection injury, meaning that men and women are compensated differently because of their different risks, then to correct for the difference would require a change in the definition of infection injury in the Patient Injury Act.

However, if the gender difference turned out to derive for reasons other than different risks, patients' treatment processes and practices related to the compensation of infection injuries should be subject to a thorough review by independent experts.

To our knowledge, the impact of comorbidities on filing a claim and receiving compensation had not been studied before this research. The consistent finding across the three surgical procedures examined was that patients in a worse health state are more likely to file a claim than patients in a better health state. This is a situation in which patients' increased risks of adverse outcomes may have indeed been realized so that these patients in effect may have suffered from true adverse events. Obviously, other reasons are possible, such as patients in a worse health state being less content with their care than patients in a better health state (Rahmqvist and Bara 2010). Patients' health status, however, might affect receipt of compensation only in the case of infection injuries and even then its effect is not entirely clear, since comorbidities reduced the probability of receiving compensation for infection injuries following CABG but not following THA and TKA.

If the patient's health status affects compensation in the case of infection injuries, but not in the case of treatment injuries, this would be consistent with the current Patient Injury Act according to which the patient's health status and medical history should be taken into account in the case of infection injuries and unreasonable injuries but not in the case treatment injuries – at least for the latter such explicit statements are not apparent from legislation. In practice, however, judging whether and to what extent the patient's health status and previous medical history have contributed to an adverse event is often difficult (Brennan et al. 1991a, Johnson et al. 1992). This is a further important reason for thorough and detailed analysis of the route and contributory factors to an adverse event as suggested in Section 7.1.

The remainder of the patient-level variables studied for their association with claims and compensation also deserve commenting. First, the finding that cemented prosthesis reduced patients' claims following THA should be confirmed with more recent data to see whether the result would still be relevant with the prostheses currently in use. If a similar result emerges, current practices in choosing implants should be subject to reconsideration. Second, the reason why the amendment to the Patient Injury Act had a statistically significant effect on claims and compensations in connection with CABG and not THA or TKA is explainable by CABG involving a larger number of infection injuries – the type of compensable injury that was mostly affected by the legislative amendment. Third, the statistically significant association of the previous operation -variable on receiving compensation following TKA might originate from the fact that patients and decision-makers at the Patient Insurance Centre most certainly compare the success of patients' arthroplasty with their previous contralateral operation. If the outcome of the previous operation was good, the patient probably stands a better chance of receiving compensation for a bad outcome. The reason why the same variable did not emerge as statistically significant with regard to THA remains open.

Overall, the observed impact of patient characteristics on claims and compensations suggest that policy-makers and health professionals should give more consideration to patients' equal possibilities to file a claim and encourage patients to pursue a claim when compensation seems likely. Advancing equity in filing a claim might also progress from improving the patient safety culture of health care organizations, whereas it is possible to tackle inequities in compensation payments via the procedures discussed in Section 7.1.

An obvious shortcoming in this research was that it did not include data on socioeconomic status of patients, such as income or education. It is uncertain, however, if such variables would have had a statistically significant effect on either a claim or compensation, because previous studies have not provided definitive results as to the relationship between claims and patients' socioeconomic status. Furthermore, patients' socioeconomic status might have correlated with comorbidity, as comorbidities are in general more prevalent in lower socioeconomic groups.

7.3 Implications of the research for improving patient safety

Since the nature and frequency of different types of patient safety problems and their causes vary greatly, improvements in patient safety are possible with a range of different approaches that target just those factors contributing to adverse events (Vincent 2012). Nevertheless, approaches to improving patient safety are classifiable into two principal lines that are not necessarily mutually exclusive: 1. standardisation and simplification of processes including approaches that aim at reducing opportunities for health professionals to make errors, for instance, information technology and 2. health professionals' awareness and anticipation of possible errors and their subsequent actions to prevent such errors (Vincent 2012).

An approach that would probably be preferred by health economists is one that takes into consideration the costs and effectiveness of patient safety interventions and implements these according to their cost-effectiveness, starting with the most cost-effective intervention, then implements the second most cost-effective, the third and so on (Warburton 2005). This approach has the advantage that it produces the largest patient safety improvements for the lowest costs and incorporates into evaluations of cost-effectiveness the number and severity of adverse events. Whether the inclusion of the number and severity of adverse events to be prevented by a specific intervention will result in the reduction of more severe or more numerous adverse events will depend on various factors, for instance, the type of the adverse events to be prevented by and the magnitude of the effect of the intervention.

Economic evaluations of patient safety interventions have dealt with, for instance, computerized physician order entries and infection control programs, but

their number is still limited and substantially more such evaluations are necessary (Øvretveit 2007).

Whether directing TKAs to high volume hospitals – the intervention implied by Study II – would be a cost-effective approach is difficult to say. On the one hand, directing TKAs to high volume hospitals might improve outcomes of TKAs, so that in principle, positive effects from such an intervention are possible. On the other hand, the costs of such an intervention are not known and their estimation would require further research.

The reason why high volume hospitals seem to have less compensable injuries is that a larger number of arthroplasties might then be subject to simplification and standardisation of processes. Another reason might be that possibilities to spread the skills and know-how needed in arthroplasty surgery might be easier within a single large hospital organization than across many small organizations.

It was somewhat surprising, though, that an association between hospital volume and compensated claims appeared only in the case of TKA but not THA. The explanation may be that hospital volume has perhaps a larger impact on the outcome of TKA than THA, while surgeon volume has a larger impact on the outcome of THA than TKA (Shervin et al. 2007). Furthermore, a previous study did not find any statistically significant relation between volume and claims, possibly because the study utilized data that combined volumes of both hip and knee arthroplasties and did not distinguish between the type of injury (McGrory et al. 2009).

Obviously, the conclusion regarding hospital volume should be confirmed with data from more recent years, but according to the Hospital Discharge Register the conclusion might still be relevant: In 2010, only a fifth of 40 public hospitals (including health centres) exceeded the annual volume of over 300 TKAs - the volume size that was negatively associated in Study II with compensated treatment injuries. The average and median volume across hospitals in 2010 were 212 and 178 TKAs, respectively, while the number of hospitals performing less than 50 TKAs was 7 (the numbers mentioned include primary operations without revisions). Similar figures are observable for THAs. For instance, in 2010, the number of hospitals that performed 300 or more of these procedures was 5 out of 40. The average and median volumes in 2010 were 154 and 124, respectively, while the number of hospitals with less than 50 THAs was 9. All the mentioned figures change only slightly if revision arthroplasties are included.

The above figures also indicate that the recommendation of the Ministry of Social Affairs and Health in 2001 to concentrate hip and knee arthroplasties at hospitals with at least 200 of these operations – calculated as both primary and revisions combined – per year did not have much impact. In consequence, if decision-makers considered concentrating arthroplasty surgery at larger hospitals again, they might have to adopt tools other than a recommendation, such as legislation on minimum annual numbers of operations or introducing financial incentives such as sanctions or rewards.

An obvious limitation to both Study I and II was that data on surgeon volumes were not available. Furthermore, it was impossible to estimate the optimal number of arthroplasties per year that would minimize the rate of compensated claims because of the limited number of hospitals with large volumes.

Although the register data available for this research did not allow for analysing the route with all contributory factors leading to patients' injuries, the results of Study IV clearly indicate that such analyses should not only focus on the treatment processes of compensated claimants but also on those of claimants denied compensation. The claims of claimants denied compensation may not be groundless and their care may have involved substantial problems.

The additional health care costs of claimants estimated here most likely originate mainly from the claimants' adverse events and not from other causes. The reasoning comes from Table 2 which shows the majority of claims entail adverse events. Adverse events were present in 97% to 98% of claims in studies that comprised large samples of claims (Cheney et al. 1989, Studdert et al. 2006). In studies that linked medical record data to claims the percentages were lower, from 44% to 79% (Brennan et al. 1991a, Brennan et al. 1996, Thomas et al. 2000, Studdert et al. 2000, Davis et al. 2003, Bismark et al. 2006b). The differing percentages across studies may derive from the different methods used. On the one hand, medical records may not reveal all adverse events (Taylor et al. 2008, Weissman et al. 2008, Zhu et al. 2011). On the other hand, data consisting only of claims may bias researchers towards more readily accepting the presence of an adverse event, thus resulting in the larger share of claims with an adverse event in the latter kind of studies.

Although the increased health care costs of claimants are probably associated with these patient's adverse events, the cost increase is unlikely to equal the additional costs created by an adverse event as such. The reason is again apparent from Table 2, which shows that the vast majority of patients, from 97% to 99%, with an adverse event do not file a claim, implying that the costs of non-claimants comprise the costs of the vast majority of patients with adverse events. Moreover, as pointed out previously, the adverse events of claimants may be on average more serious than those of non-claimants (Table 3), which may bias the costs of adverse events – if estimated on the basis of the costs of claimants – upwards. This "upward bias" may in effect signal the increased severity of the adverse events of claimants. To confirm this idea, further research on adverse events and their costs in Finland would be required.

Study IV calculated the differential in health care costs, but not in total societal costs. To obtain the latter one would have to take into account income and household production losses. These are known to constitute about half and health care costs the other half of total societal costs of adverse events (Johnson et al. 1992, Thomas et al. 1999). The inclusion of income and household production losses might have widened the cost differentials even more, as claimants are more likely to have more severe injuries and to be working-aged persons. Furthermore, non-monetary

costs such as worries and anxieties of claimants might be more substantial than those of non-claimants.

It is important to remember that an adverse event eligible for compensation in Finland may not necessarily be defined as a preventable adverse event or as an adverse event at all if a different definition of an adverse event or expert opinion is used. Such discrepancies emerge also from Table 2, in which retrospective judgements differ from actual judgements regarding compensation and may also vary across studies and countries.

Finally, if considering to which medical specialities and surgical procedures patient safety interventions should be directed in Finland then the conclusions are similar to those in studies from other countries (Pukk-Härenstam et al. 2008, Jena et al. 2011). Overall, the distributions of claims between specialities, DRGs, and even service types following linkages in this research were fairly similar in both the year 2000 and 2002, although the linking of the data for 2000 involved considerable subjective judgements (J.J et al. unpublished results).

Nevertheless, the distribution of claims between inpatient and outpatient care in this research (J.J. et al. unpublished results) differed markedly from the study by Bishop et al. (2011), which found almost equal rates of claims for both inpatient and outpatient care. A possible reason for this difference may be that the data in this research dated from a period when a larger share of health services was provided in inpatient care than in the study by Bishop et al. Other explanations may be the uncertainties related to linking of the Patient Insurance Centre data with the Hospital Discharge Register as well as differences in treatment practices and real rates of filed claims between this and the study by Bishop et al.

Given the wide variation in hospital districts' claim rates in Figures 1 and 2, it was somewhat surprising that adding hospital dummy variables to the statistical models in Studies I and II did not have a statistically significant association with either filing a claim or receiving compensation - with the exception of one hospital that was associated statistically significantly with filing a claim following CABG, THA, and TKA (results not reported here). Possible reasons could be that dummy variables are too crude to account for differences between hospitals or that in the long-term, differences between hospital claims rates are not very large.

7.4 Implications of the research for measuring patient safety

Hospital-level claim rates seem to quantify some aspects of quality, because statistically significant associations emerged between claims and hospitals' five-year revision rates as well as one-year deep infection rates.

A claims indicator – an indicator that would measure the rate of either filed or compensated claims at hospital level – would have both strengths and weaknesses.

While the indicator would be fairly easy to construct for routine monitoring and it would possess many of the other characteristics required of a performance indicator (Smith et al. 2008), it would not be very sensitive to quality and patient safety improvement efforts as suggested by the very small odds ratios (Study III). In effect, health care providers would have to make substantial investments in patient safety such as improvements to teamwork and clinical decision-making before any remarkable changes in the claims indicator would be observable. Interestingly, a similar finding was made in a study in the United States that found poor quality of nursing homes to increase filing of claims statistically significantly, but only slightly (Studdert et al. 2011). However, the size of the reduction in claim rates following patient safety initiatives would obviously depend on the type of association between claims and quality (or patient safety) as well as the initial level of claim rates, implying that providers with a very high claims rate might observe larger reductions than providers with average rates (Mello and Hemenway 2004).

A further weakness of a claims indicator would be that it would not contain very up-to-date information due to information on claims dating back several years. Moreover, the indicator might not be entirely free of the influence of providers, because providers might have some effect on patients' claims decisions, for instance, by creating a patient safety culture that either encourages or discourages claims. There is no research data to support the latter view, but introducing a claims indicator into the regular performance measurement of providers might be subject to some doubts and even resistance by health professionals.

Since claims are not equally distributed within a hospital, one would have to evaluate whether the hospital level, a specific medical speciality, or certain treatment procedures would be the best level for comparisons of claim rates across hospitals. Depending on the chosen level, one would also have to consider the appropriate denominator: for instance, whether claim rates are related to the rate of admissions, treatment episodes, surgical procedures or other denominators, because the content of these may vary between different hospital types, such as highly specialized university hospitals and less specialized local hospitals. Such evaluations imply that one has to balance between sufficient sample size and an appropriate comparison group, i.e., the more homogenous the comparison groups, such as specific patients groups, the smaller the sample size, which, however, hinders comparisons between hospitals.

Nevertheless, a claims indicator holds promise as a performance indicator that allows for comparisons both between hospitals and within-hospitals across time. Due to its shortcomings, patients, health authorities, health professionals, and others should use the indicator in conjunction with other performance indicators or incorporated into quality and patient safety programs.

A further opportunity implied by this research for developing the measurement of patient safety is to monitor the differential in health care costs between claimants and non-claimants. If a reduction (increase) in the cost differential between claimants and non-claimants is observable, this might then be an indication of a reduc-

tion (increase) in the number or severity of adverse events. Since the group of both claimants and non-claimants comprise patients who have suffered adverse events, monitoring of costs can only be a crude indicator.

7.5 Feasibility and limits of register-data in studying patient injury claims

A number of studies have shown that data compiled in the Hospital Discharge Register are exact and comprehensive (Sund 2012, Gissler et al., forthcoming) and enable the measurement of treatment outcomes for selected patient groups (Sund et al. 2007, Peltola et al. 2011). Furthermore, data on comorbidities are reliable in cases in which data are combined from both the Hospital Discharge Register and registers of the Social Insurance Institution, i.e. the registers on patients' rights for reimbursement in the special reimbursement categories for medicines and patients' medicines purchases (Gissler et al., forthcoming).

Nevertheless, one marked shortcoming of the Hospital Discharge Register is the inadequate recording of secondary diagnoses (Gissler et al., forthcoming). The degree to which health care organizations record secondary diagnoses into their own administrative computer systems and pass these on to the Hospital Discharge Register varies greatly. In addition, health care organizations in Finland do not record secondary diagnoses at hospital admittance, which hampers comparisons of the patient's health status before and after hospital treatment. These are, as already mentioned, the main reasons that obstruct the utilization of OECD quality and patient safety indicators in Finland.

Recording of diagnosis and surgical procedure codes denoting complications from care as well as the use of codes specifically designed for the Hospital Discharge Register to indicate adverse events are also inadequate (Rintanen et al. 2010). Similarly, recording of hospital infections is insufficient, but recording is better in the case of more serious infections (Kanerva et al. 2008). Nevertheless, recording of serious deep infections of joint prosthesis in the Finnish Arthroplasty Register, and therefore probably also in the Hospital Discharge Register, is not as complete as in infection surveillance projects (Huotari et al. 2010).

The insufficiencies in noting down secondary diagnoses are said to have many origins, including differences in treatment patterns between rural and urban areas and in the utilization of inpatient and outpatient care (Gissler et al., forthcoming). An important contributor is also said to be poor recording by clinicians. Clinicians may perceive coding as a threat to performance requirements and a nuisance particularly with all other paperwork that already consumes a marked share of their working time. Consequently, among the solutions suggested in various forums are developing and evaluating information technology together with health professionals, making the choosing of codes easier for health professionals (e.g. via touch screens),

creating financial incentives, providing immediate feedback and information on patients' long-term outcomes, producing summaries automatically, and expanding the usability of coding to the benefit of clinicians.

When evaluating the practicability of the Hospital Discharge Register in quality and patient safety measurement, a general deduction is possible from the above: Indicators that rely on secondary diagnoses or on outcomes observable in primary and private outpatient care are not feasible. However, indicators that rely on information on primary diagnoses, procedure codes indicating major surgery, the presence or absence of an admission, provider organization, and transfers between provider organizations are feasible. Similarly feasible are indicators based on historical data such as patients' primary diagnoses and utilization of inpatient care in the past (Sund et al. 2007, Mäkelä et al. 2011, Peltola et al. 2011). Feasibility of the Hospital Discharge Register increases further if its data are combined with other registers, such as those of the Social Insurance Institution and statistics on Causes of Death (Gissler et al., forthcoming, Mäkelä et al. 2011, Peltola et al. 2011).

As information on injury severity is such an important determinant in the patient's decision to proceed with a claim (Table 3), it would have been important to include in this research. Severity does not appear directly from the Hospital Discharge Register but can under some circumstances be assessed indirectly in a crude way by comparing different outcomes that by themselves reflect severity. For instance, a revision operation following a joint arthroplasty within a time span that a prosthesis normally endures or a deep infection of the operated joint are much more serious outcomes than the average readmission (Study III). Nevertheless, the assessment of the severity of an injury probably would necessitate the use of data other than the Hospital Discharge Register, for instance, medical records and interviews.

A clear advantage in using registers for studying patient injury claims was that it linked data from several registers and allowed for study samples of both claimants and non-claimants to be included in the study. Usually, only claimants are investigated in studies that explore material contained in individual claims folders (Vincent et al. 2006). Nevertheless, a disadvantage in the use of register data was that registers do not allow for taking into account the possibility that an injury occurred from the succession or interaction of several contributory factors, some or each of them in separate medical specialities, outpatient visits, or admissions. To view the entire sequence of contributory factors it would be obligatory to compile material in claims folders and possibly other data sources.

A further disadvantage was that register data do not allow the exploration of factors such as patients' subjective views about their motives for their claim and aspects related to the physician–patient relationship, which would have been possible with data from interviews (Table 3). Moreover, health care registers in Finland contain limited information on provider-related factors. In addition to surgeon volume, other useful data would have comprised numbers of health care personnel, duration of operation, medications used in inpatient care, and other aspects related to the

management and organization of care. Furthermore, this research did not include any information on the activities of patient ombudsmen, the patient safety culture, or health professionals' attitudes toward the handling of adverse events. To obtain such information, studies utilizing data other than register data should be conducted, for instance, observational studies or surveys of health professionals and hospitals' administration.

7.6 Suggestions for further research

As discussed above, research that utilises exclusively register-based data has limitations and can offer only selected perspectives on patient injury claims and compensations. For that reason, future research should utilise other kinds of data in addition to registers. The other potential data sources are essentially interviews, observational studies, hospitals' administrative computer systems, medical records, incident reporting systems, global trigger tools, executive walk rounds, complaints, and autopsies (Thomas and Petersen 2003, Naessens et al. 2009, Levtzion-Korach et al. 2010). Furthermore, documents contained in individual patients' claims files in the archives of the Patient Insurance Centre are an additional possible data source. All these different types of data have their advantages and disadvantages (Thomas and Petersen 2003), which is a further reason for utilising a combination of different data.

A research project for the future could comprise interviews in which researchers would question claimants about the adverse events they experienced, similarly to the patient interviews conducted by Taylor et al. (2008), Weissman et al. (2008), or Zhu et al. (2011), and then compare this information with the content of the documents compiled by the Patient Insurance Centre. Furthermore, such interviews could question patients about their views of and experiences with the claims handling process at the Patient Insurance Centre and their views on necessary improvements, as well as collect information that would allow for the measurement and comparisons of quality-adjusted life years between claimants and non-claimants.

Interviewing claimants would shed light on patients' views of and experiences with the processing of claims and perhaps bring out ideas for its further development. Moreover, interviews would help in the assessment of possibilities for making additional data sources available for the Patient Insurance Centre, whether the Centre could adopt structured interviews of patients (and possibly of health professionals and health care organizations' administrative personnel), which kinds of cases would benefit from such interviews most, and what additional resources would be required. There would also be a need to evaluate the extent and effectiveness of the poorly known feedback system of the Patient Insurance Centre and make suggestions for its further development.

Another future study could collect data from the different authorities that deal with patients' claims or complaints: claims data from the Patient Insurance Centre, complaints directed to the administration of health care organizations as well as complaints directed to the Regional State Administrative Agencies and the National Supervisory Authority for Welfare and Health. Combining data compiled by these authorities would permit comparisons between their data, assessing to what extent the data sources complement or supplement each other and what role each could have in monitoring and improving patient safety. Further interesting information would be obtainable if the Patient Insurance Centre data were combined with data from an epidemiological study on adverse events. Whether such an epidemiological study will be conducted in Finland remains to be seen.

Studies that would examine retrospectively the patient's entire treatment process and factors contributing to an adverse event – for instance along the lines of Rogers et al. (2006), Regenbogen et al. (2007) –are scarce in Finland. In this country, such analyses would be necessary as well, and they could assist with the classification of contributory factors, which could then serve in developing the register of the Patient Insurance Centre, as suggested above, and in finding remedies for factors predisposing to adverse events. Such a study could also include cases processed by the Patient Injuries Board to compare practices, decision-making and other possible differences between the Board and the Patient Insurance Centre.

Since this research focused on three surgical procedures (CABG, THA, and TKA), procedures other than the three and conservative care as well as primary care should be an area for future research. Future research should also aim at collecting data on patients' socioeconomic status and provider characteristics, such as surgeon volumes, data that were not available for this research. Since in this research the number of compensated claims was fairly low, particularly with regard to CABG, future research should also aim at increasing the number of observations with a successful claim.

This research did not perform any studies on the monetary value of compensation payments. The amount of payments is difficult to study, because payments include compensation for income loss, which varies according to the patient's income, but foremost, because estimates of episodic payments are imprecise. Nevertheless, future research should try to address this area by investigating the horizontal and vertical equity of compensation payments and whether and to which degree compensation payments compensate patients for all their losses. A need for such research is also implied by studies on tort systems that have indicated vertical equity being realised in compensation payments – with more serious injuries obtaining larger compensations – with the realisation of horizontal equity being inadequate when the size of compensation of similar injuries has been compared (Sloan and Hsieh 1990).

It would be of interest to know to what extent defensive medicine exists in a country with a no-fault scheme such in Finland. Studying defensive medicine is not

easy and even the results obtained in studies in the United States involve uncertainties (Danzon 2000). Possible research approaches in Finland might be comparisons of actual treatment practices to clinical guidelines where treatment should not in principle involve many variations, or comparisons of treatment practices of medical specialists within one medical speciality at one hospital on basis of medical records, or on the basis of interviews of health professionals; if treatment practices indicate notable excess of service provision this might be indicative of defensive medicine. A further approach could be to interview health professionals to obtain information on their perceptions of the presence of defensive medicine. However, to investigate defensive medicine on the basis of changes in the Patient Injury Act – such as the amendment to the Patient Injury Act in 1999 – similar to studies in the United States where changes to legislation or other parts of the tort system were used for studying defensive medicine (Kessler and McClellan 1996) is perhaps more difficult, as these do not directly affect individual health professionals.

The scarce research to date on the patient injury insurance scheme in Finland and the various possibilities for future research are apparent from the few peer-reviewed studies on the Finnish scheme cited in the reference list and from the large number of non-peer reviewed information sources listed in Appendix 5.

8 Conclusions

This was the first research project to link patient injury claims data in Finland with data from other national health care registers. The linking allowed examinations of claims in a way that has not been possible in this country before. More importantly, the study widened our knowledge about no-fault schemes for compensating patient injuries, which has been extremely limited thus far.

In addition to highlighting the strengths and weaknesses of the patient injury insurance scheme in Finland and suggesting improvements to the scheme, the research produced the following main findings:

The propensity to file a claim differed significantly between patient groups. The elderly were less likely to file a claim, whereas women and patients in a worse health state were more likely to file a claim than men and patients in a better health state. Nevertheless, age did not seem to affect elderly persons' possibilities to obtain compensation provided they had filed a claim (with the exception of treatment injuries following TKA). However, compensation for infection injuries seemed to occur more often in the case of male claimants than female patients. Whether this difference was derived from the different risks of an infection or from true inequities between men and women necessitates further research. Furthermore, patients in a worse health state were less likely to obtain compensation following CABG, but an effect of health state did not appear following THA and TKA. Overall, the observed differences between patient groups suggest that policy-makers and health professionals should pay more attention to patients' equal possibilities to file a claim and encourage patients to go on with a claim if they seem to deserve compensation.

Hospitals with a larger volume of TKAs had less compensable treatment injuries. This result indicates that TKAs should be carried out at larger hospitals to improve the quality and patient safety of these procedures.

Rates of filed and compensated claims following THA and TKA showed statistically significant associations with revisions and deep infections. This suggests two things: 1) claims are associated with some dimensions of care quality, at least with regard to THA and TKA and 2) claims are related to more severe injuries. The latter conclusion was derived indirectly from the observation that serious outcomes (revisions and deep infections) had an association with claims, while such an association did not appear between claims and less serious outcomes (re-admissions). Further research, however, should be done on the association between claims and quality to see whether the results apply to patient groups and surgical procedures other than THA and TKA.

An indicator measuring claim rates of hospitals might be a useful performance indicator. It should be used in combination with other indicators or incorporated into quality and patient safety improvement programs, as it meets the characteristics required of a performance indicator only in part.

The health care costs between compensated claimants and claimants denied compensation did not generally differ, suggesting that the care of claimants denied compensation has also involved substantial problems and that the claims of the latter are not groundless. Consequently, the treatment processes of compensated claimants and importantly also those of claimants denied compensation would require more in-depth research.

The obvious challenges in the conduct of the research were the low numbers of claims (in particular, compensated claims), the long time to accumulate a single year's claims data (due to claims being possible several years later after an adverse event) as well as the difficulties related to the linkages of data. Furthermore, having been restricted to register data only, the research had limited possibilities to obtain information on all the individual factors that might play a role in the occurrence of adverse events generating claims. For instance, data on various provider characteristics such as surgeon volumes and numbers of different types of health care personnel were not available.

Future research should use in addition to register-based data other data sources, such as interviews and data from observational studies, as well as focus on identifying the entire process and the individual patient- and provider-related contributory factors that lead to patient injuries.

Acknowledgements

The idea of studying patient injury claims arrived by accident rather than by design. Research Professor Unto Häkkinen, after having heard of the Finnish Patient Insurance Centre's register on claims, immediately saw the possibility of using it for research, and suggested I write a thesis that would build on these data. I myself did not have any particular preconceptions on the topic at that point, but in the course of time, the research has proved to be an extraordinary learning experience and has opened up a completely new area within health care for me, with many thought-provoking but generally unknown and neglected features.

I am deeply grateful to Research Professor Unto Häkkinen for his supervision and advice throughout this research. His widespread and superb research experience and understanding of the health care system in Finland were of great advantage in undertaking this thesis. Particularly in situations when a problem seemed almost impossible to solve, his imagination and ability to quickly grasp matters were of great help.

I owe my sincere thanks also to my other supervisor, Professor (emeritus) Harri Sintonen, another outstanding health economist, for his invaluable comments and viewpoints and for drawing connections between my work and health economics. His seminars directed at PhD students were educational and stimulating.

I am greatly indebted to Professor Gunnar Rosenqvist for having participated as a co-author and for having instructed me at many stages in this research. Not only is he an excellent statistician and researcher but he also has a talent for explaining statistics and other research-related matters in a concise and understandable way. Discussions with him taught me a lot about doing research. I also appreciated him paying sufficient attention to details when I thought this necessary.

My warmest appreciation goes to Adjunct Professor Erna Snellman and Professor Sverre Grepperud, the preliminary examiners of my thesis. Their constructive and comprehensive review improved the thesis significantly and compelled me to look at many issues from viewpoints other than those I had initially considered.

My sincere gratitude goes to Research Professor Markku Pekurinen for his encouragement and, while serving as the Director at CHESS, for improving the possibilities to do research within the unit; to Research Professor Ismo Linnosmaa for sharing his knowledge and our discussions on the health economic theory on incentives for injury prevention; to Research Professor Ilmo Keskimäki for his helpful views at the planning stage of this work on the feasibility of using patient injury claims data for research, and Adjunct Professor Ville Remes for his critical comments on Study II and for widening my knowledge on orthopaedics.

I owe my deep gratitude to the Finnish Patient Insurance Centre for providing me with the data for this research. My sincere thanks are due to Reima Palonen for reviewing the sections describing the Finnish patient injury insurance scheme. These sections are an accurate and trustful source of information, for which I take

final responsibility; nevertheless, should an error appear, a no-blame scheme of course will be invoked.

My sincere thanks go to my colleagues at CHESS: Mikko for helpful discussions on the construction of the THA and TKA datasets and for sharing thoughts on the research of arthroplasty surgery; Merja and Timo for making the appropriate CABG cost variables available to me; Lien and Hennamari – previously at CHESS – for sharing their knowledge and experiences in writing a thesis; and the former and current computer analysts at our unit for always patiently answering my many questions regarding SAS and SQL.

Thanks are likewise due to other colleagues at CHESS and other units at the National Institute for Health and Welfare, THL (and previously STAKES where I began this research) for those numerous inspiring, encouraging, and instructive discussions – often blended with humour. THL with its experts and facilities has been the perfect working environment for this kind of research.

I owe my grateful thanks also to Mark Phillips for his diligent work with the language check of both the thesis and the original studies.

I give my deepest gratitude to the Yrjö Jahnsson Foundation for awarding funding for this research.

I am deeply grateful to my parents, Irja and Markku, for the many positive things they gave me in my childhood – among my favourites being my diverse opportunities to enjoy music and theatre – that have helped me through difficulties later in life. I am also extremely grateful for them for having always been happy to take care of my daughter Rita. My dad deserves special thanks for building me a computer for use at home that brought much more flexibility to my work. I owe my sincere thanks to my sister Johanna for helpful hints and discussions on editing English language. I owe both her and her family my heartfelt thanks also for the care given to Rita and for otherwise helping out in pressing times. I thank my friends and relatives who by either sharing their own experiences on a thesis or otherwise taking great interest in my work have supported and encouraged me.

My deepest and sincerest thanks go to my husband Kimmo. Your flexibility, patience, input into the care of our household, intelligent comments, humour, love, and you just being there by my side have enabled me to do this thesis. During the most intensive times in this work when I could not join you and Rita at playgrounds, for swimming, or in other activities, I was consoled by my knowledge that you were taking the utmost care of her. And, thank you for being you, Rita. The thought of your personality just as it is and the richness you have brought to our life has always cheered me up in the many lonely hours of writing. Whatever you pursue later in life, follow what your heart tells you. In concluding this thesis, I send my love to our other daughter, Astrid, somewhere upon a star.

Helsinki, September 2012
Jutta Järvelin

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Appendix 1

Linking rules for combining data for the year 2000.

The main linking rules that were used for linking Patient Insurance Centre (PIC) data from the year 2000 with data from the Hospital Discharge Register (HDR), including Hospital Benchmarking data, are presented in simplified form here. For a claim to be linked to an admission or a visit, the encrypted personal identity number and hospital code had to be the same in both datasets, and the injury date had to fall between the admission and discharge date or be the same as the date of a visit. In addition, one of the below rules had to be fulfilled. It is important to note, though, that the linking of about 20% to 30% of claims required considerable subjective judgments. Moreover, date and hospital code criteria were loosened in those cases in which other information indicated that a claim might possibly be linked with an admission or a visit.

PIC code	HDR code
Surgical procedure (PIC own code)	Inpatient care or day surgery
Injury from casting (PIC own code)	Medical speciality surgery
Delivery (PIC own code)	Medical speciality obstetrics or paediatrics
Diagnosis code fracture	Medical speciality surgery
Diagnosis code indicating gynaecological disease	Medical speciality gynaecology
Anaesthesia (PIC own code)	Inpatient care or day surgery
Diagnosis code indicating eye disease	Medical speciality ophthalmology
Radiation therapy (PIC own code)	Medical speciality oncology
First digit of diagnosis or surgical procedure code the same as in HDR	First digit of diagnosis or surgical procedure code the same as in PIC
Injury from clinical examination (PIC own code)	Injury linked to an out-of-hours visit, if indistinguishable whether injury occurred during out-of-hours visit or admission
After applying above rules: check and linking of remaining cases where personal identity number and/or hospital code equal and/or injury date between admission and discharge data (or equal to visit date)	

Appendix 2

THA and TKA dataset: steps in linking Patient Insurance Centre's data with data from the Hospital Discharge Register (x = criterion applied).

Step	Personal identity number equal	Provider unit code equal	Diagnosis and procedure code equal	Injury date falls between admission and discharge date	Admissions identified with a claim	Note
1	x	x	x	x	708	
2	x	x	x		22	The injury date as indicated by the Patient Insurance Centre data was allowed to be at most 120 days before the patient's THA (TKA) admission began or at most 120 days after it. The reason for this time span was that a patient needs from two to three months to recover from THA (TKA) before a contralateral joint replacement can take place. Thus, observing one or several procedure codes for a primary joint replacement within this time span should in principle refer to one and the same operation.
3	x		x	x	29	The Patient Insurance Centre's differing hospital codes consisted mainly of codes that had not been updated similarly to those in the Hospital Discharge Register
4	x	x		x	86	The Patient Insurance Centre diagnosis and procedure codes were missing, misspelled, or indicated a medical procedure that is performed in conjunction with THA or TKA, such as a procedure related to anesthesia.
5					–	Check of claims that could not be linked: 107 claims with a THA code and 90 claims with a TKA code that could not be linked to any admission were according to the Hospital Discharge Register filed by patients with secondary osteoarthritis, were related to operations not included in our dataset, or to surgical procedures other than THA or TKA. Consequently, these claims were ignored.

Appendix 3

Diagnoses applied as exclusion criteria in the formation of the THA and TKA dataset (if patient's records contained any of the diagnoses mentioned below, she was excluded). The diagnoses were for the most part the same as in Mäkelä et al. 2011

Hospital Discharge Register from 1987 until THA (TKA) inclusive		
Diagnosis	ICD-10 code	ICD-9 code
Hip and knee		
Inflammatory joint diseases and joint diseases related to specific chronic conditions	M05*, M06*, M07*, M08*, M09*, M12*, M13*, M14*, M45*	713*, 714*, 716*, 696*, 7200A
Coagulopathies	D66*, D67*, D68*, M362	2860A, 2861A, 2862A, 2863A, 2863B, 2863C, 2863D, 2863E, 2863F, 2863G, 2864A, 2865A, 2867A, 2867B, 2867X, 2869X
Osteochondrodysplasia and other congenital malformations	Q77*, Q78*, Q79*	7564A, 7565A, 7568C, 7568X
Hip		
Secondary osteoarthritis	M16.2, M16.3, M16.4, M16.5, M16.6, M16.7, M16.9	7152E
Infectious joint diseases	M00*, M01*, M02*, M03*	7110E, 7111E, 7113E, 7115E, 7118E, 7119E
Fracture of the femoral neck	S72.0, S72.1, S72.2	820*
Fracture of the acetabulum	S32.4	8080A, 8081A
Osteonecrosis	M87*	7334B
Juvenile osteochondrosis of the head of the femur	M91.1	7321A
Non-traumatic slipped upper femoral epiphysis	M93.0	7322A
Congenital malformations of the hip	Q65*	7543A
Knee		
Secondary osteoarthritis	M17.2, M17.3, M17.4, M17.5, M17.9	7152F
Infectious joint diseases	M00*, M01*, M02*, M03*	7110F, 7111F, 7113F, 7115F, 7118F, 7119F
Fracture of the lower femur	S72.4	8211X, 8212A, 8212B, 8212X, 8213A, 8213B, 8213X
Fracture of the patella	S82.0	8220A, 8221A
Fracture of the upper tibia	S82.1	8230A, 8231A
Osteonecrosis	M87*	7334C
Social Insurance Institution's register on eligibility for special refund categories for medications over the year preceding THA (TKA)		
Special reimbursement category		Code
Connective tissue diseases, rheumatoid arthritis and comparable diseases		202
Sequelae of organ transplantation		127

Appendix 4

THA and TKA dataset: comorbidities controlled for in the construction of the quality indicators in Study III (comorbidities were defined for the most part in accordance with Mäkelä et al. 2011).

Comorbidity	ICD-10 or ICD-9 code from 1987 until THA or TKA exclusive (Source: Hospital Discharge Register)	Special refund category during the year before THA or TKA (Source: Social Insurance Institution) [a]	Medication purchases during the year before THA or TKA (Source: Social Insurance Institution) [a]
Hypertension	ICD-10: I10*-I15* ICD-9: 40*	Chronic hypertension	Diuretics and beta-blockers (except for when atrial fibrillation and ischemic heart disease is present), calcium channel blockers, and selected ACE- inhibitors
Coronary heart disease	ICD-10: I20*-I25* ICD-9: 410*-414*	Chronic ischemic heart disease and disorders of lipid metabolism associated with ischemic heart disease	
Atrial fibrillation	ICD-10: I48* ICD-9: 4273*	Chronic arrhythmias	Warfarin
Heart failure	ICD-10: 150* ICD-9: 428*	Chronic heart failure	
Diabetes	ICD-10: E10*-E14* ICD-9: 250*	Diabetes	Insulin and other medicines for lowering blood glucose level
Cancer	ICD-10: C00*-C99*, D00*-D09* ICD-9: 140*-208*	Several categories for medications used in the treatment of cancer	Cytotoxic drugs except for methotrexate
Chronic obstructive pulmonary disease or asthma	ICD-10: J44*-J46* ICD-9: 4912*, 496*, 493*	Chronic asthma and similar chronic obstructive pulmonary diseases	COPD drugs
Depression	ICD-10: F32*-F34* ICD-9: 2960*, 2961*, 2069*		Antidepressants
Parkinson's disease	ICD-10: G20* ICD-9: 332*	Parkinson's disease and similar conditions	Anti-Parkinsonism drugs
Dementia	ICD-10: F00*-F03*, G30* ICD-9: 290*, 3310*	Dementia	Dementia drugs
Renal failure	ICD-10: N18* ICD-9: 585*	Renal failure requiring dialysis	
Mental illness	ICD-10: F20*-F31* ICD-9: 295*-298* (except for 2960*, 2961*) (except for dementia)	Severe psychoses and other severe mental illnesses (except for dementia)	Antipsychotic drugs

a Precise codes available from the author.

Appendix 5

Legislation, internet sources, and other non-peer reviewed Finnish documents cited as references.

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